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AN EXPEDITION TO THE CENTRAL ANDES OF PERU, 1939

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THE reasons for the organization of this expedition to the Central Andes are unusual. As a student of the late Professor J. W. Gregory nearly thirty years ago I was infected with some of his interest in this giant mountain chain. The account he wrote of the Andes in his 'Physical geography' in 1908 encouraged curiosity which chance was to stimulate and partially satisfy. The Anglo-Persian Oil Company, Ltd., despatched an expedition to Peru in 1924 to examine a small area in the north of the Republic, and when it ended in 1925 an opportunity presented itself to me to pay a brief visit to the Central Andes, to walk for a few days amidst exhilarating scenery, and see for myself the well-exposed structures awaiting to be unravelled by making a map of them. In the next three years many hasty journeys in the north over some thousands of miles of road in Venezuela and Colombia extended my knowledge of the problems and kept my interest wide awake. When Professor Gregory himself explored the country from Ica to Cuzco and was then so tragically lost in the rapids of the Urubamba river I resolved, if my service with the oil company permitted, to try to make a map of part of the Andes, in part to read a page in an uncut book, and in part to carry on the work initiated by my friend and master. After twenty years at grips with the great mountain chains of the world in Asia, Europe, and North and South America, a new life at Oxford commenced, and I set about preparing to spend a long vacation in the highlands of Peru before the progress of years should have crippled that activity which map-making in high mountains entails. The technique acquired during years of reconnaissance in the Zagros ranges in Iran was available and proved serviceable in the Andes. The survey showed that by the use of a plane-table on a stand with a light Johnson head and a Barr and Stroud 80-cm. range-finder it is possible to work almost as quickly in the high Andes as in the lower mountains of Persia.

Thanks to generous grants, one from the Government, allotted by a committee of the Royal Society, and one from the Trustees of the Percy Sladen Memorial Fund, any financial strain the survey might have imposed was eliminated. The Royal Geographical Society, Lord Cadman, and Mr. B. K. N. Wyllie kindly lent me instruments that were essential, whilst the Gill Memorial awarded to me at an opportune moment was invested in ample photographic materials. The finding of scientific associates was more difficult than I had expected, and apart from my able and energetic assistant, J. D. Weir, the Burdett-Coutts Research Scholar at Oxford and a Canadian Rhodes Scholar, I sought technical colleagues in vain. As the ideal party for the work I contemplated consists of three or four, another Rhodes scholar who had just completed his geological studies, C. H. Kearny from Texas, agreed to come, and at the last moment M. H. Donald, an experienced traveller and collector with whom I had traversed the Caucasus, joined the expedition. The *Reina del Pacifico* left Liverpool on the day that term ended and brought the party to Peru by July 6.

Through the good offices of Mr. Mackehenie, an Honorary Fellow, and of our Society the help of His Excellency the Minister of Peru in London and of our Foreign Office had been secured, and they saw that the authorities in Lima had been informed of our coming and were waiting to speed us on. The officials of the Peruvian Government and Mr. V. C. W. Forbes, the British Minister, and his staff were so gracious and active that in four days the party had left the capital with preliminaries completed. I wish to acknowledge my special gratitude to Mr. G. W. Morkill, General Manager of the Peruvian Central Railway, for many facilities granted to us and for looking after our well-being during the whole period of our stay. It is also a pleasure to be able to refer to much help and hospitality from officials of the Cerro de Pasco Copper Corporation, particularly Messrs. Spilsbury, Colley, Walker, and Beamish, and from several Peruvian gentlemen, including Señores Pascual Carpena, Carlos Otero, Mario Cabello, and Alberto Barreda. Finally I had the advantage of discussing my plan in advance with Professor J. A. Douglas in Oxford, and Professor D. H. McLaughlin in Harvard. Advice from those who knew the region in which we were to work led to the choice of Tarma at 10,000 feet above sea-level as our base (see map following p. 328). Mr. N. A. Whitten, who housed us in his hotel, put us into contact with useful people, and the Sub-Prefect of the Department, Señor J. Andres Seville, assisted us in every way.

The transport on which we were relying was to be animal. Fifteen years ago trains of pack-mules were abundant; now they are all but things of the past. There is now only one firm remaining which has a mob of mules. These are used to carry the mail between La Merced, in the forest about 50 miles east of Tarma, to the head of navigation at Puerto Bermudez on the Piches river on the way to Iquitos. The Delgiudice Brothers, in view of the official backing we enjoyed, kindly hired us twelve mules at a reasonable rate and we paid for fifty-six days' hire in advance. If it was difficult to come by mules the obtaining of muleteers was still more so. The old school of tough, hard-working muleteers who faced the hardships of the road unconcerned is rapidly dying out: their trade is gone with the advent of trucks which ply over the steadily growing network of roads. In future men to look after mules will

be found only by chance. The peasants still load their own few beasts with the products of their farms and take them to market, but rail and road handle all the principal trade. Any one who contemplates mule travel in Peru is now faced with a difficulty which used to be unknown, and if exploration be attempted in years to come it is hard to say how transport will be arranged. A few mules still come on the market at Huancayo and at Huancavelica, from which places it might be necessary to buy beasts for an extended tour. Donkeys cost but little and are easy to feed and to pack, but the size of loads they can carry is smaller. The main difficulty with donkeys is their troublesome love affairs, in pursuit of which they travel embarrassing distances from camp. Llamas are available, cheap, and abundant, but the loads they carry have to be easily balanced and not very bulky. At the start of our trip the mule owners supplied us with two of their own professional muleteers, but one fell out in less than a week, and the other decamped a few days later with sartorial spoils filched from a member of the party. For the rest of the time our mules were looked after in a perfunctory manner by the best men we could get, but they never stayed with us for more than a few days at a time. Loading was thus always a slow process and constant readjustments had to be made *en route*.

It was with concern that I heard that the men we took with us would have to be fed. Past experience pointed to trouble from this source, but it was useless to suggest commuting food into money, for it is not customary. Thanks to Mr. Whitten we met and obtained the services of a Scot who after a long war service found a happy hunting-ground in the highlands of Peru. James Campbell joined us in Tarma to superintend camp arrangements and he took much of the burden of camp chores and the daily move off our shoulders. For our work to proceed with maximum efficiency eight men were needed to go out with us every day on the hills, and about four for odd jobs in camp such as pitching tents and drawing water. In addition there had to be a cook, which in fact meant a cook and helper. The cook was hard to find, but when he did materialize he proved to be an excellent fellow who was knowledgeable and able to pack a mule better than any of our surrogate muleteers: in fact, Campbell and he were often saddled with the brunt of this work. The peons with few exceptions were without endearing qualities. Only one of the original gang stayed the whole course, and he came from the coastal part of Peru. The only hold on the men was to have a proportion of their earnings unpaid in our hands. If this was paid up it was almost always followed by prompt and unannounced desertion. The reliance one has so often put on the peons with whom we stride the hills was always unfortunately lacking here. All through this journey we paid a little more than local rates, about 1*s* 8*d* per day with food, but we were nevertheless almost always short-handed, and it needed the friendly support we received from the local officials to relieve an acute labour situation now and then. No appeal to the local governor for an extra man or two was ever fruitless, although the recruits provided would often decamp after a single day. It was not unusual for us to have to carry loads ourselves so that the work should not be held up; especially to start with, the average daily climb of 3000 feet was quite arduous enough without added impedimenta. Still we moved most days and very rarely were any of us

compelled to accompany the caravan at the cost of missing a day's work on the hills.

Food for the party never had to be carried for very long periods, but it involved quite enough staff work to see that we were not reduced to short commons. Potatoes are the staple diet in the country and they were bought by the sack. Rice and macaroni are normally consumed by the peons together with mutton to make a stew. The men from towns and villages live upon bread, which had to be included when possible. Coffee was supplied each morning and evening, and a daily ration of 1 oz. of coca leaf, a substance they chew and expectorate most of the day. It is reputed to keep them in a pleasant frame of mind. Finally four cigarettes were given to each man daily. To meet the bread consumption was difficult and involved a good deal of coming and going between camp and the villages near the Mantaro valley. By detailed personal supervision sufficient supplies of most foodstuffs were usually available to carry us on from point to point.

In the upland country in which we travelled fuel was another preoccupation. Oil stoves had been brought from England which were deemed adequate for the needs of the party, but the only petrol on sale contained the lead compound. If this fuel is burnt in a pressure stove it quickly obstructs the needle valve. This reduced the reliability of the stoves to nil and their efficiency, when they were coaxed to work, to about 50 per cent. At best they would have been insufficient for the needs of the whole personnel, and so local fuel had to be sought. Dried cow dung is most easily secured and seems to be fairly efficient relative to its weight. A poor quality of peat is dug in the higher swamps, but it dries very slowly and is usually stacked in quantities just sufficient for local use. Both these fuels were burnt in a brazier made out of a lubricating-oil drum upon which the biggest pot which Tarma could supply boiled potatoes or skilly for the men. There is also a sharp reedy grass which will burn, growing in tufts rather like the rushes along a stream-side in the Scottish highlands. It flourishes in patches where soil or drainage suits and makes most exasperating going either uphill or down. A sickle was carried to cut fodder for the mules and with it clumps of the grass could be gathered. It is a whole-time job for two men to supply enough rushes to keep a serviceable fire going, but with diligence a pot can eventually be boiled with their aid. The fuel position had always to be watched by a member of the party or else the prevailing opinion that "sufficient for the day is the fuel thereof" might prove disastrous on the morrow. There are not any patches of timber left in this country, and there is no evidence that the high pampa was ever forested, but I have seen the hills in Persia which were once all tree-clad now completely bared except around the sanctified tombs, and therefore I am not convinced that there may not have been some trees here in the pre-Inca days. Presumably the much denser population of those days had eventually at least also to rely on dung as their principal fuel.

Tents were carried to house every one. As mess and work tent there was a 10×8×7-foot double-fly Stormhaven tent with an attached ground sheet. One member of the party slept in it. The other three each had a 7×7×6-foot tent with ground sheet sewn in, two being Niger and one a Whymper. For the cook and stores we had a $8\frac{1}{2}\times7\times6\frac{1}{2}$ foot tent, whilst the peons slept in an

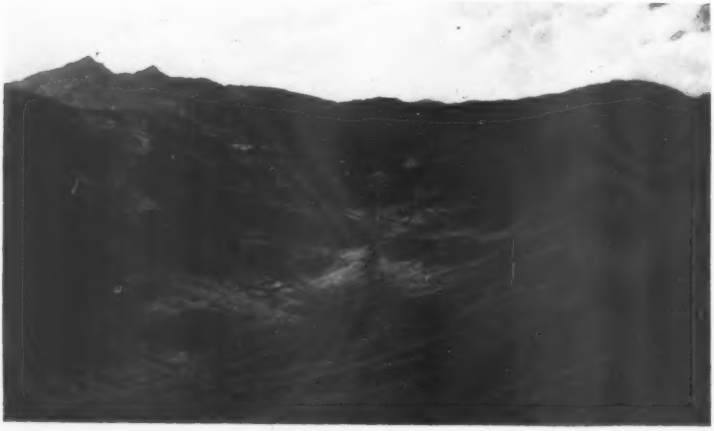
Looking north across the valley of Morococha

The Central Plateau dissected by the Mantaro

The Yauli valley from the continental divide

Glaciated hillside north of Yauli

Waterfall over tufa terrace near Quiro



Glaciated valley above Quiro

Icelandic one 13×8×6 foot. A canvas sheet was also carried to cover saddles and oddments of kit. Each member of the party had a locally made wooden box for his necessities, and two others were carried to house scientific instruments, medicine chest, and some more valuable stores. Tea, sugar, cigarettes, coca, and butter were also locked up to reduce what seemed to be inevitable pilfering. After sundown it was frosty most nights. An Aladdin heater was used successfully in the work tent, but the others were unheated and extra clothing had to be relied upon to keep out the cold. If the size of the party had been reduced by the scientific staff doing camp work much less mapping would have been achieved. On this expedition the main objective was to make the most of a definite brief period.

The weather was very unusual. We started to camp on July 17 and were under canvas until September 11. Hardly a day passed without some snow flurries or thunderstorms. In July on several occasions 3 or 4 inches of snow fell. On clear nights it was cold and the temperature once reached 20° of frost. When there was precipitation it was much milder. At heights up to 15,000 feet snow seldom lay till noon even if the sky was completely overcast. Especially in the more eastern part mist came down badly, rendering survey work temporarily impossible. In normal years the thunderstorms are said to occur once or twice a week and are local affairs staged in the afternoon, but in 1939 they occurred almost daily and thunder was often booming away early in the forenoon. The storms usually moved up from the south-west in the teeth of the prevailing wind. Lightning frequently takes a toll of cattle and occasionally a man is struck. Flashes thrice occurred so close to members of the party that no perceptible interval lay between them and the crash, while the tang of ozone was sharp following the discharge. The north-east wind rose daily and blew strongly, increasing to a maximum about 2 p.m., after which it tailed off towards evening. It was observed that worse weather accompanied a veering eastwards, and better weather came with a more northerly component. The relatively small difference of 2000 feet in elevation made a great difference to the weather. By descending to the sheltered valley of the Mantaro river at about 11,000 feet it was possible to escape at once from the rigours of the plateau climate. The men nearly all dreaded camps above 14,000 feet, and it was only by maintaining resolutely that we should not have money to pay them until we reached a town that we were able to retain them while we crossed the higher passes. Their restiveness coupled with bad weather in some of our higher camps entailed some modifications of our itinerary. There was universal agreement however that conditions were bad. Natives and foreigners alike said so, and at length I was told that the records kept by the Cerro de Pasco Copper Corporation showed no such broken weather in the dry season for seventeen years. In ordinary years camping is practicable in the high country from April till the end of October, and most of the time the weather is bright and clear if cold.

Our mules were slowly loaded on July 17 outside the hotel in Tarma. They only set off at 3 p.m. along the south-easterly road for Tarma Tambo and Huaricolca. This first stage was about 3 leagues away and 2000 feet higher. A farm-house was kindly lent us for that night so that a late start for once was

of little account. At Huaricolca the gum trees which beautify the valleys of the Tarma district can just exist, and there is here the last plantation of what may be called the Tarma oasis. Higher up the country is treeless. On this range between 12,000 and 15,000 feet above sea-level there are rolling acres of poor pasture. Sheep thrive on this and the farm at Huaricolca is entirely given over to them. The second day we went to work and left the camp staff to move about half a mile and pitch camp for the first time. No cook had yet come, and the unaccustomed stoves and tents gave much trouble. The valley here runs south-east and is overlooked on the south-west by a fine array of grey limestone crags. Their front is breached here and there by small lateral valleys leading up to the plateau, which extends for some miles beyond the summit of the cliffs to the south-west, covered with yellow grass.

There is a little village below the farm where the main valley and the lateral one which carries the water supply unite. In it the houses are built of adobe bricks, or of the same mixture of mud and straw tamped in between boards just as a concrete building is erected. Most of the cottages are single storied, but occasionally two-storied buildings are made in which the upper part serves as a barn. Framed by gum trees of varying hues of green the red-tiled roofs and the whitewashed walls formed an attractive picture. There are patches of terrace and alluvium near the village capable of irrigation by simple ditches, and in July the harvest of wheat had been cut and was being treated with flail and wind to separate the straw and grain. Each peasant turned his horses, cows, donkeys, and pigs to glean amongst the stubble or the straw of the harvest floor. Most of the villages have a water-wheel and mill in which their grain is ground, but what happens to it after it has been sold in one of the local markets I do not know, for wholemeal flour is not a retailed commodity in any part of Peru nor is wholesome brown bread sold by any up-country baker. This is rather surprising since in Tarma there is one working baker who purveys a variety of types of bread. In the villages where bread is baked the ridiculously purified white flour is usually imported and insipid rolls produced. Barley is another crop, but the grain is ground to flour, which is then toasted and mixed with any liquid. A similar foodstuff came to my notice in the Isthmus of Tehuantepec in Mexico, where the Indians treat maize in the same way, and carry the maize meal as their only food when on a long journey. Our men used to carry the meal dry and work it into a paste, if possible with coffee. We had scones made from this meal and found them a pleasant change after the characterless village bread.

Another day at Huaricolca enabled the staff to settle down, the cook to instal himself, and us to traverse the broken country north-west where the watershed lies between the Tarma and Ricran river basins. Long narrow parallel valleys controlled by the linear arrangement of the rocks below are the main features of the headwater terrain. Such a traverse, first to the south-west and then to the north-east along this transverse watershed, was required to let us establish a rather long line of points at right-angles to the direction of our route so that the map could be carried on into the lower ground south-eastwards. The chief danger of error accumulating on a plane-table survey, without instrumental control, comes in when a ridge between river basins has to be crossed, especially when followed by a move directly away from the

crossing up a valley with broken country on either side. The wider the points are apart on the ridge, the less the chance of error occurring. The views obtained on this occasion of the surrounding country were useful, as the last visit to this area nearly at the end of the survey was made in a snowstorm when map-making was quite impossible. The divide stands at about 13,300 feet above sea-level, with knobs on it rising to 14,500 feet.

Our first real move was to Puyi. The mules crossed the divide on the motor road which connects Tarma with Jauja at a place called Inca Tacuna, where the Inca rested as they travelled along their roads in days gone by. For the next 3 miles the route followed their road. Broad it is and straight it runs. Steps are still preserved where it goes downhill too steeply for comfort and it contours at stream crossings as little as possible. In our region some fragments of the Inca Road were surprisingly well preserved, although places between them seemed to show no trace of it. This relic of the past savoured to us more of romance than did any of the dilapidated walls and villages of about the same antiquity scattered lavishly along the Mantaro valley. It recalled the prodigious relay races which seem to have been a routine of communication in the days before the Conquistadores. The old routes are used little enough nowadays, for movement follows the graded motor roads where the pedestrian goes in hopes of a lift from a passing truck.

Camp was pitched beside the Inca Road at the little village of Puyi. It consists of a few shacks, low-walled straw-thatched bothies strongly resembling the "black houses" in Skye. By each hut is a circular pound into which the sheep are herded every night, for the foxes abroad on the hill take a toll if the sheep be left unguarded. In many parts of the upland pampa between 13,000 and 16,000 feet above sea-level there are abandoned shacks and corrals, but Campbell told us that many of them are occupied from time to time. Pasture which is far from water is held for grazing in the wet season, while the slopes above a stream or spring serve during the dry one. Convenience demands two houses therefore, a winter and a summer resort for the same flocks, the two being often only a few hours apart. The few inhabitants of Puyi showed small interest in us and we soon appreciated that the peasant in such a village, called an *estancia*, wishes to have no dealings with the outsider. The flocks are taken out to grass shortly after sunrise and herded in again before sunset. There is no cultivation close to this village, although it is probable that there will be arable land in the valley below, the rights to cultivate it being the reward for shepherding the sheep for the owner and landlord in the nearest hacienda. In spite of rather squalid details the little valley of Puyi formed a not unpleasing study in yellows and browns, brightened by a narrow fringe of green along the edge of the runnel fed by the spring responsible for habitations being there at all. A hill standing 800 feet higher is high enough to overlook the rolling hills called *puna* or *pampa* extending south-westward and the broken country north-eastward, into which the feeders of the Ricran have eaten gullies, now encroaching rapidly. Beyond them rise the jagged peaks of Yuracmayo. A pall of mist hid them most of the time during the earlier part of the journey, and it had not been possible to intersect the peaks. One lucky morning in September the clouds rolled away when the plane-table was established only 3 miles from them and enabled me to fix them. This friendly unshrouding

lasted about an hour and was followed by a thunderstorm, and it in turn by a snowstorm which continued two hours.

The start from Puyi was considerably delayed by mules wandering off. To provide mounts in case of need we had bought a horse and mule from a farm about 10 miles away. These beasts were on known ground, and anxious to return home; they broke away, setting a bad example to the others. When a camp site was reached the animals were turned out to grass until sunset, when the muleteers collected and tethered them to tent pegs with a small supply of fodder to keep them going during the night. The muleteers kept no watch, and there was none of the security found in the mule lines of a Persian camp in which all the animals are tied to the same hide rope pegged out firmly at four corners forming a square. The muleteers sleep inside this around a fire and almost under the hooves of the beasts they tend. More by good luck than good guidance all our animals except two were reassembled in time to load for the short move demanded of them that day. The two homing creatures had to be brought back from their farm of origin. At this time when harvesting was in progress a little fodder could be bought, but generally none was to be had, and the animals had to run loose till dusk or starve. After a very few marches the urge to decamp evaporated as the poor brutes were far too busy foraging.

Sacas, where we camped next, is larger than Puyi. It stands in a valley about 1000 feet below the level of the pampa. Harvest was being gathered from the small wheat and barley fields perched on little terraces engineered on the steep hillside. The crop is cut by sickle. In some cases only the head is removed; in others the stalk is taken also. A donkey may be used to carry the sheaves to the harvest floor, but often the family is inspanned to effect this transport. The well-to-do husbandman piles his sheaves and drives mules or donkeys around to trample out the grain, just as in Persia; but the poorer one gets into the heap himself and lays about him with a pliable pole 10 or 12 feet long. The straw is then shaken out and the residual grain winnowed by throwing it into the wind. One farmer we passed used a sack with a small hole at one corner: the grain with its husk was filled into this and then trickled out while the sack was held a few feet from the ground, the strong afternoon breeze producing the desired differentiation. The harvest was given as an excuse to deny us donkeys, of which we needed a few to carry provisions. During the harvest animals are made to work for a few days at a time, but at other seasons they are called on infrequently to carry a load to a Sunday market. In Sacas a few looms are at work where a woollen cloth is woven from the yarn which every shepherd spins to pass the time as he watches the sheep. The shepherds are sometimes seen knitting too, and their socks and gloves are serviceable affairs. Milk cows and some sheep were housed in the village, from the precincts of which all grass has been removed. Now there is soil erosion. The dust, dung, and debris make Sacas one of the less attractive works of man.

The stage from here to Jagachaca on the Ricran involved a climb of 2000 feet up and down. We camped on a football pitch, on alluvium subject to flooding, outside this pleasant village of whitewashed, red-roofed houses on the side of the Ricran. The spread of football and basket ball through Peru

is another notable change in the last fifteen years. The press in Lima devotes much space to sport in the capital, and each of the larger towns has its team. Every village and every hacienda has a pitch of its own. Even at this high altitude they play a good fast game, but there is a tendency to take defeat rather too seriously. The game has proved a real boon and has greatly reduced the abuse of alcohol. A motor road now passes through the village and runs on to three big haciendas down stream. Upstream it soon joins the road over which molybdenum from the Janchiscocha mine is shipped to the railway at Jauja. Limestone cliffs loom up above the village north-eastward and the country above rises to a ridge of about 16,000 feet. Ruins of ancient towns stand on alps far above the river. The population is scanty now, and all employers agree that the man-power available is insufficient for the developments they would like to carry out. The course of events in the last decade in Europe leads to the reflection that a civilization like the Inca's, which luxuriously organizes itself for peaceful pursuits, soon falls a victim to a predatory one organized for war. Never did one pay a higher price for its choice than the Inca State, where a handful of adventurers trained to ruthlessness decimated an industrious people whose ruined towns still testify to the thoroughness of the killing. Lands now carrying a population of less than ten per square mile once supported more than a hundred. It remained a wonder to us all through the journey, to encounter town after town high above water, and to see the abandoned terraces tempering the slopes to make them yield a living to such a throng. Now the same area can support only a few sheep.

We wished to study the eastern watershed, and held up the Ricran valley for a long stage. The steading of a large hacienda stands at Cayán (123,000), and a little higher up the mill of Janchiscocha Mina is built on a tributary of the left bank. The tailings from this cloud the river for many miles, but its concentrates have provided Japan and Germany with a much-prized alloy. Few have had more cause to bless the political tumult of these later years than the miners of Janchiscocha, wooed first by this and then by that nation for its coveted output. Somewhat higher the stream followed a glaciated valley to the first of many rock-basin lakes and a branch to the right led to a pass at 15,000 feet beyond which extends the pampa of Azapite on which we camped. We soon had 4 inches of snow around us, and shared a fine airy plateau with a flock of grazing llamas. To find camp here proved hard, for although it commanded a fine vista to the east it lay in a fold of the ground hidden from the west from whence we were travelling. At dusk one of the party had not come in, but by good luck he had found tracks of the mules before the snow commenced, and had followed in the right direction. After the evening snowstorm the morning broke bright and clear. We made for a peak 15,600 feet high to the north-east of camp and were rewarded with a view embracing much of the broken mass of glaciated hills lying along the watershed between the basins of the Mantaro and Comas rivers. The scene recalled winter landscapes in the north-west highlands of Scotland around Gareloch at the time when the heather is dark. Sharp barren peaks stand up above an ice-scoured ground dotted with innumerable small lakes confined to their rocky basins. Even the colouring is similar, for many of the rocks are tinted

red of the same hue as the cliffs of Slioch in Sutherlandshire. Snow was lying in streaks on the southern faces of the crags, and corries have been cut out here and there on the same side. Only the distant mist-filling of the Comas valley could be seen from here. This year at least there was much more mist in the Eastern than in the Western Cordilleras and work was sometimes held up by the poor visibility. A few roads cross the ridge but are hard to follow except at the col, where they are clear enough. Traffic now is scanty owing to the new motor road in the east, but small groups of donkeys still cross it laden with odds and ends. We saw a small drove of cattle being driven south to the market at Jauja from the lower pastures of the Comas river.

Flocks of sheep and llamas graze amongst these wild hills. The sheep are watched and taken to a pen each night, but the llamas stay out untended. In spite of this abundance of sheep around us not one could we buy. There is an enabling law making it legal for a hungry traveller to choose a sheep, take it from the protesting shepherd, cut its throat, pay the shepherd, and move on. In practice it is sometimes inexpedient to apply such a law on account of probable repercussions on local labour. It seemed however that we should be otherwise unable to replenish our stores, for a descent to the little village of Quiro to extort help from the Lieutenant Governor had proved useless, as he was away and had left no deputy. As if sent by Providence, when it seemed that no help was forthcoming, a man came along the road with a donkey laden with beef. We saw such a load only once during our trip. They said the cow had probably died, but even so meat is meat, and we bought 100 lb. In the same village we met an old bearded man with two unladen donkeys which we badly needed, for one of our mules was not well. I proposed that he should hire the donkeys to us for three or four days and come on to our pay roll himself. He cheerfully and immediately agreed. Then I blundered, for I let him out of my sight, and although the road ran through a narrow gully from which there seemed to be no lateral exit, both he and the donkeys disappeared. The next two days were spent high up where mist and snow interfered both with our task and our comfort. The road from Quiro was extremely rough until it had climbed more than 1000 feet and emerged on to the floor of a wonderful U-shaped valley with the most perfect chains of lateral and terminal moraines that I have ever seen. We climbed obliquely from the stream-bed to avoid a rock-step and entered a great corrie above with a colourful lake on its floor, where camp was pitched.

The track we followed next day went steeply up the corrie side to a pass at 15,000 feet, where it left the main trail which, keeping to the north-east, traverses a large gentle U-shaped valley leading down to the Comas river valley. Our road turned east and south-east, wandering for a time amongst the roches moutonnées before dropping down over a rock step on to a series of moraines deposited along the flanks of a glaciated valley debouching to the south. Snow flurries blew up many times during the day, and with our mules obviously tired out the stage was shortened and camp pitched 400 feet above the valley at Conco. There is only one "black house" with a couple of corrals here, and there were no people in residence. Information regarding our route ahead was vague, and the afternoon was spent reconnoitring. The caravan was to move to the low country at once instead of following the south-easterly

route I had planned. To have carried on would have resulted in foundered mules and inconvenient desertions. The animals headed off south-west next morning while I climbed steadily south-east to a fine jagged tooth at 16,000 feet, from which the glaciated high pampa and the array of snow peaks to the south-east could be studied. Fortunately the day remained bright, so that by following the main spur from this peak to the south-west a useful chain of stations was established to help us carry on in the hole below formed by the plain of the Mantaro valley between Jauja and Huancayo. It also provided points in view of the Concepción–Satipo road which could now be tackled with motor transport. A short trip was planned for Weir in the lower ground south of Jauja, on which the mules would not be taxed and so be able to regain condition. In the meantime I would do what was possible along the road to the north-east.

Before these arrangements could be affected however the national festival of Peru of July 28 was celebrated. We spent it in the village which we reached that afternoon. The red-tiled houses forming Masmachico are strung out for a long distance along the left bank of an attractive valley at about 12,300 feet, in which the green grass and groves of gum trees appeared luxurious to us after the naked upland. Early on the morning of the 28th groups of peasants dressed in their best, and each with a gun, went down the valley to a parade of their territorial force. Bugle calls disturbed the hillside. The women appeared in brightly coloured Sunday raiment and they drove the animals out to pasture bedecked with red and rellow ribbons tied to their horns, or passed through slits in their ears, or plaited into their hair. These decorations recalled the custom of the tribal people in Persia who bedeck their animals at the New Year feast on March 21. Although our men had procured rum the previous evening and had kept up a noisy hubbub all night, they mostly went off early to Jauja, for being townsmen the town drew them to it like a magnet. Thanks to a 6-mile walk from the nearest station on the railway they returned none the worse. This is the principal national fiesta, but each town and hacienda has its own saint whose day is observed locally, followed by rejoicing for about a week. Each hacienda has a chapel amongst its buildings as surely as it has a barn, and the fiesta starts with a mass said by the priest from the nearest town. The farmer pays for this and provides music and a feast for all the retainers and their friends who come to dance and eat. Pedlars appear bringing still more food and drink, but normally the fiesta peters out by the end of a week. In a town the sequence of events is much the same, but a bull fight is usually included in the programme. In one town when a fiesta was on during our visit the town council had included a special feature. Each householder had been instructed to paint the outside of his house so that it looked particularly smart and well kept. The pigments used were mostly terra-cottas or yellows, obtained by making a paint of the ores from neighbouring mines.

The stream at Masmachico has cut a fine gorge above the village, and as is usual in the streams draining the slopes we had been following, it has cut an asymmetrical V-shaped trench below the glaciated channel in which it rises. These gullies nearly all have very steep north-western slopes and more moderate but still steep south-eastern ones. This asymmetry of the channel is not dependent upon the underlying rock structure, for the streams cut right

across the trend of the beds. The only explanation which seems to be likely involves the warmth of the afternoon sun. This factor has affected only the south-eastern wall of the gully, which has thus experienced an almost daily freezing and thawing, with the result that the slopes have been modified and their gradient lessened. About 2 miles below Masmachico the river turns west and then north-west before entering the Jauja plain. Immediately above Huamali there is a low col over which the drainage once discharged, although it is now the watershed between a runnel flowing north-east to the Masmachico river and one depending steeply to Huamali. The origin of this capture is in some way related to the flooding which submerged the Jauja region and the new drainage pattern etched upon the lake beds deposited there when the damming barrier broke down. The evidence for this lake is provided by beds of buff-coloured silt, sand, and gravel heaped up around Jauja to a height 12,000 feet above sea and 1000 feet above the present level of the Jauja plain. They form a very fertile soil, most of which is cultivated. Famous Inca ruins stand upon them and they have yielded bones of the large extinct megatherium. Other traces of this lake have been found miles away where patches of the same kind of beds are perched on the present valley sides.

The town of Jauja stands at the foot of this terrace on a fan blending with the wide plain of recent alluvium. It is the first of a series of towns scattered along both sides of the wide tract through which the Mantaro meanders in a braided bed to Huancayo and below. The river enters the plain through a deep rock gorge and in the lower reaches runs in a notch cut through the sheets of gravel which may have formed the dam of the Jauja lake. These are probably the results of floods occurring at the end of the period of maximum glaciation. Whatever the causes, this expanse of alluvium and the gravel terraces are favourable to a concentration of population. Small towns have been built at many points, where rock and alluvium meet close to any adequate water supply. The climate is agreeable. Anything will grow without special care and arable land is extensive. The railway and a new motor road both serve the district.

The Government is steadily opening new roads to motor traffic. One of the newest of these connects Concepción on the edge of this plain with the Satipo river in the Amazonian forest. We visited this road four times with varying fortune. The first time I contracted for a car in Jauja planning for a five-day journey. On this occasion two of us reached the town of Comas on the first day and were abandoned by our car before dawn on the next. By a lucky chance a lorry came to the town and took us back to Concepción on the third day. The second time Kearny went to Santa Ana, situated at kilometre 182, and back in thirty hours. He rode on the front seat of a lorry and paid seven shillings for the return journey. At times the lorry carried forty-one other people and their kit and naturally only stopped infrequently, so that it was not very adequate for a geological survey. The third time we hired a handsome and extremely expensive car. Its only drawback was that after the first few hours it could not be relied upon to go. After some hours pushing it on the third day we were glad to get a lift back on a lorry. The last time Donald travelled back from the very lowest point on the road in a government car at high speed. We concluded after the first three trips that mule transport is not

Glaciated landscape at Llanaclara

Hanging valley above Yauli

Cascades of tufa near "Cut off"

The Ricran valley from Maco

Maco hacienda

A weaver at Sacas

the only kind which may sometimes prove a little difficult. As a result of all this effort a valuable addition was made to the map. Some plane-tabling was done on the first day's ride to Comas by leaving the car and climbing a volcanic spike to the east of the road. From this we looked straight on to the snow mountains lying north-east of Huancayo, and over the glaciated country and the many lakes which are littered about near the divide. We joined the car again in an open glaciated valley across the divide, but soon ran out of it into a fearsome gorge down which the road runs as a single track, cut in places from the solid rock. The roof overhangs the road here and there, and for the last 15 kilometres to Comas it is no more than a narrow ledge cut in a steep bank from crags above to a stream below. Zigzags to gain height are not infrequent and rounding many of them can only be accomplished by backing and filling. The regular lorry drivers have an admirable technique for this operation. A boy travels on the back of the lorry. He drops off at the hair-pin bend, seizes a rock, and inserts it under the tyre when the truck has run back dangerously near the edge of the precipice. Although the road is one way there are passing places now and then. The dissection rapidly increases. At Comas it is around 5000 feet and farther down the water flows at 8000 feet above sea-level, while the spurs above stand at 15,000 feet.

Comas stands well above the main river upon a spring-fed brook of its own and overlooks the most intense development of artificial terraces we saw in Peru. Potatoes are the main crop. To employ the enforced stay I climbed the valley to a ridge 4000 feet up and was rewarded by a few minutes there without mist. I was able to resect this point and join it to others below by moderate shots with the range-finder. The lorry journey started at daylight, so I dropped off about 20 miles from Concepción, climbed 1500 feet to a neighbouring peak and worked down a spur from it, establishing a line of resected points to the town which was reached just after dark. One of the few comfortable hotels in this region happens to be at Concepción, and the proprietor, who is a gardener, keeps his patio a blaze of colour with geraniums and other flowers. His garden provides an object-lesson in what might be done to beautify the countryside. On my second journey along the Satipo road we made at once for the farm of Runatulla at kilometre 91. Our big Buick began to display distress as we left Alapampa at 8300 feet, where the Comas bears to the left and the road takes to the gorge of the Runatulla at kilometre 73. After various halts the car only just made the hacienda, where we, although perfect strangers, were most hospitably received and housed and fed for two nights. The main objective was to reach the ridge lying about 5 miles north of this house, and we were lucky to do so. The Buick on our second day would not start. Long-distance trucks usually pass on two days in the week, and no help could be expected from them. Milk is collected from the outlying estancias by lorry which brings it daily to the hacienda. It was this lorry which took us up 18 kilometres to the summit at 14,400 feet. A climb of 2000 feet from here put us on an upstanding knob with a glacier below it commanding an excellent view of the neighbouring mountains. On one of these a glacier is cut by a black beak of rock in a curious fashion. This point had been intersected from points near Comas, and although the rays only formed an acute cone it was possible to apply the work done that day, when mist interfered

with efforts at resection, to a sketch-map of the road Mr. Whitten had provided. The mapping done from four stations depended upon a base measured by range-finder. The photographic record obtained from these points was unusually good, the ice and snow providing striking contrast. The glaciers in this range are numerous and reach rather lower levels than they do in the Western Cordilleras which we were visiting later. Kearny's journey by lorry added little geographical knowledge, but he returned with a very useful collection of rocks from these eastern slopes, which the other members of the party did not visit.

In the meantime Weir had mapped the strip of country between Jauja and Aco. He gave fatherly advice to the local mayors who are gravely concerned about their shrinking water supply. Their springs are few and the wells seem to be drying up. Some of these villages at a distance from the river were flourishing and it seems as if others already house as many people as their water supply can support. Jauja is adequately watered and could easily expand, although it stands nearly 2 miles away from the Mantaro. Its people are reputed to be extremely fond of going to law. With this in mind I was not too happy when the owner of the ground where we had camped approached me for compensation. It seemed our mules had stripped the bark off the gum trees, and this proved to be true. I had no idea what a tree cost, but there was no doubt that three trees would not survive as they were ringed. Fortunately the proprietor's ideas were not extravagant, and when divided by two, reasonable. On this basis an amicable settlement was reached out of court. The shopkeepers here are a mixed lot. Japanese predominate, as they do in most parts of Peru, but here we met a Jugoslav and an Austrian as well. From the camp at Jauja a strip of country to the north was also examined in which lies the large marsh-fringed lake of Chocon, reputed to give good sport at certain times of the year. Duck-shooting is to be had on most lakes and, especially at higher elevations, we seldom saw a lake without a pair of geese somewhere near it.

From Jauja camp was moved a few miles west to Marco, which lies on the shore of a small lake fed by drainage from the Sacas basin, with no outlet. We continued our journey after various digressions across the hills westwards. The road climbs from the village to the pampa about 1000 feet above. A ruined town stands on this about 500 feet above the stream, which can hardly have been flowing at an appreciably higher level in Inca times. It remains a mystery how such a town obtained its water supply. Presumably every drop had to be carried up, though whether by donkeys, or llamas, or the people themselves cannot be said. Sherds of pots are many, and we saw none of the peasants using goat skins for water at the present time, so it may be that the water was carried by men or women, who alone could carry a pot. The site for such towns must have been chosen when there was no menace to their security, for with such a precarious water supply they must have been peculiarly vulnerable in a siege. Two miles farther on across the Cachichachi the village of Pomacancha and several small hamlets stand at the foot of a wall of cliffs running north-west and south-east, and steep tracks climb from them to the south-west, cross the upland, and reach the ridge which forms the Heights of Oroya. This constitutes the watershed at about 15,000 feet between

the Mantaro and its tributary, the Cachichachi. The rolling topography of the old plateau is well preserved here, but it is deeply incised to the south-west by the short streams which drain into the Mantaro, dropping 3000 feet in about 3 miles. High spurs left between these maintain height until they overhang the gorge in which the river flows. A few patches of ice once clung to the southern side of this ridge and quarried out corries in which small lakes still lie. Our camp stood beside one called Aricocha at 14,000 feet. The next valley to the north-west is occupied by another known as Huacaracocha. On August 12 snow started to fall heavily at the inconvenient hour of 7 a.m. It stopped by 10 a.m., but mist hung about till afternoon so that work could not be done high up. Several bad days followed and we were not sorry that it had been decided at once to seek lower levels, although this always meant strenuous climbing if mapping was to be done.

The Mantaro is too deep to ford and bridges are infrequent. We crossed at Chacapalpa by a rickety suspension bridge which served us and the baulking animals. There are two types of land division in this part of Peru. One is the hacienda, a stretch of country perhaps 10 miles square, belonging to one owner who keeps cattle and sheep on it producing butter, cheese, meat, hides, and wool. There is usually some arable land yielding potatoes and grain. The peons living in estancias scattered over this territory are almost feudal retainers, and in return for so much work they receive perquisites and a little pay. The other type is the community where a similarly large area is owned by several peasants who live scattered over it. The idea is that the community should be a cooperative unit. It is fairly certain that the community does not accomplish quite as much as the single owner; apart from minor friction there is neither the knowledge nor the capital to improve the land or the stock. Chacapalpa is a typical community, while Pachacayo, to which camp was moved next, is a hacienda at its best where no expense has been spared. One of several large farms owned by the Cerro de Pasco Copper Corporation, it has fenced fields, swing gates, irrigation ditches, and well-cared-for buildings which form an object-lesson in what can be done where initiative is backed with capital. Even the stream watering the farm has been stocked with Loch Leven trout which have flourished in spite of diligent and almost unhindered poaching. Pachacayo served as a base from which we mapped the banks of the Mantaro to Huari upstream and Llocllapampa downstream, as the trains passed at times which suited us morning and afternoon. Our animals profited also by spending a few days in the good pasture and we restocked with provisions from the neighbouring town of Oroya.

The Mantaro forms the principal drainage of most of our area, rising far to the north-west on the relics of the uplifted table-land. In the neighbourhood of Oroya it already occupies a gorge which narrows where it swings north-east and south-west, broadening out when it follows the trend of the rock bodies which run north-west and south-east. It is probable that somewhere near Llocllapampa it once followed quite another course to that which it pursues to-day and that this was filled by deposits of the Jauja lake. When this drained away the river had to carve another course for itself and chose the line of its present gorge below Llocllapampa. Its course from thence through the Jauja Huancayo flat is clearly that of a river which has incised its meanders initiated

on a lake floor or other surface which is nearly flat. In the gorge there are little local terraces, many of tufa or gravel, and below Jauja wide extensive sheets of outwash from the eastern mountains. The railway and motor road keep to the banks of the river from Oroya downstream.

A branch motor road starts at Pachacayo and climbs to a mine lying near the Continental Divide away to the south. Time did not permit us to make an excursion along it and we followed a track climbing more steeply to the west to another farm, Piñascochas, at 14,500 feet. The red foothills extending to the mountains of the Western Cordilleras rose straight from the farm to the south, and on the north gentle slopes form the surface of a large dome whose highest point stands at 15,700 feet. A defunct coal mine lies in a high gully and its buildings are used by two enterprising shepherds as pens for their flocks, kept for fattening and killing. Huay Huay lies at the branching of a canyon 7 miles long and 2000 feet deep. Like the Wadi Du'an its walls are of limestone lying almost flat upon a foundation of sandstone. Bluffs resembling the buttes along the Grand Canyon of Colorado are developed where the streamlets have cut back along linear master joints. This is unique in these Central Andes of Peru and depends upon a great slab of unfolded limestone only very gently tilted over a width of 6 or 7 miles. From its entrance to the Mantaro valley near Huari, where a vein of bitumen is worked as coal, it runs nearly straight to Huay Huay, and once the canyon was important as the road to the mines in the south-west. Fume from the smelter at Oroya affects the flocks and herds, and the mines ceased to be important, so that both Huay Huay and Huari have declined. Any hope of recovery is removed by the new motor road to San Cristobal, which would provide an outlet should any of the old mines be reopened. Huay Huay proved a good camp site for us because old tracks from it climb up lateral valleys to little hamlets and to the plateau 2500 feet above. The walk to work was relatively easy up a path with a steady if stiff gradient. A howling gale swept the top but no eddies of it reached camp. Upstream the canyon opened up into a glaciated valley at the head of which peaks with small glaciers clinging to them rise above a group of picturesque lakes. Downstream below Huari pedestrians can cross the Mantaro in a bucket slung on a rope across the river.

From Huay Huay we followed the south-eastern limb of the river, which brought us to Suitucancha, the headquarters of a community keeping its sheep between the river gorge and the snow mountains. When the glaciation was at its maximum a tongue of ice reached thus far from the peaks of the Western Cordilleras. The village, which stands at the head of the gorge, is far from attractive. Its mayor however aided us to replenish the larder, and furnished us with half a sackful of peat. We found next day that there is a small industry at the head of this valley where they strip the turf from chosen swampy patches and dry it. Only 2 or 3 inches are removed and no deep deposit like those in Scotland or Ireland is exploited here.

In these high mountains between Suitucancha and Yauli *vicuñas* run in herds. They provide delightful fur and from the fringe on their chests the finest wool is spun. A single vicuña yields only 3 oz. of this and must usually be shot to get it. A law to prohibit shooting them is backed by another prohibiting the export of vicuña skins or wool; but game laws are hard to enforce

in the thinly populated puna. Vicuñas can be seen at close quarters with a little care. They look like lightly built and delicate llamas. Their action reminded me of giraffes, nor is their build dissimilar. A shrill whistle often first betrays them, for they sound the alarm in this way almost as the wild sheep do in Persia. A few are kept in captivity on the high pampa, but this involves sound fences which few care to maintain. One herd of the rare cross between alpaca and vicuña is kept at Chichausiri near Junin.

Over the whole area in which we were mapping llamas are frequently seen. They are always curious, and when a group of them grazing on a hill first see a stranger they gallop towards him in a most alarming fashion, only to shear off when they are close enough to see that the intruder is a mere man. A plane-table set up amidst them seems to be a great attraction. Llamas often graze untended on the pampa, but some have been seen in the mixed company of sheep, donkeys, and pigs foraging under the supervision of a woman or small child. For packing easily balanced loads they serve well, but I saw no attempt to strap on to them such clumsy cargo as the mules of our caravan had to carry. So far as I know we never ate llama, nor is their meat normally exposed for sale, but it is said that when one dies it is seldom buried nor is it left lying about.

On the way from Suitucancha to San Cristobal the going was sometimes bad with thick tenacious mud: a product, after snow, of the nightly frost followed by the daily thaw. The latter part of the way improved and followed a road connecting a small coal mine with the metal mines at San Cristobal. Large llama convoys pass daily along this route crossing a col at 15,500 feet above sea-level. Extremely broken country lay between us and the Continental Divide to the south-west. Many of the peaks support small glaciers, relics of those which piled up the moraines and scooped out the basins of the lakes in these parts. The mineralization influences the scenery, for a whole mountain-side is gaudily coloured in yellows and browns where oxidation of the ore below has provided pigments. It is little wonder that the early prospectors discovered such deposits, but it was left to modern metallurgy to make the unoxidized ores profitable.

The strip of high country adjoining the main watershed is full of diagrammatic glacial features. In addition to these, valleys U-shaped by ice erosion occur hanging above a valley deepened by water and excellently preserved near Yauli (and above Victoria). Overflow channels can be seen on the hills above Mahr, and a great tail of moraine with associated fluvio-glacial gravels and sands form ridges in the valley of the Yauli river. Corries facing south are many. The most imposing glacier lies on the south of Parachte, a fine granite peak north-west of Tuctucocha, the glacial lake resting on the tread of a lofty rock step. Frost has shattered fallen blocks and produced marked striation in some screes. Streams with their falls frozen into curtains of icicles testify that the shade temperature is still low in the high sierra.

Our stage from Pomacocha to Tuctucocha was notable for the presence of a mayor-appointed guide. I had inquired whether there was a road passable for mules from Pomacocha to Casapalca. The local headman assured me that there was and detailed this guide. He was mounted and well provided with something to keep out the cold. With many demonstrations of statuesque

horsemanship he led us to Tuctucocha and at an old mine in a high glaciated valley he left, assured that he had done his duty; but he could not tell us whether there was a road leading on. It cost me an afternoon's scouting, but next day the mules crossed a col at 16,200 feet by a fair road to the railway not far away. The mules were again a worry, for they were always weary in spite of reasonable grazing, days of rest, and very short stages. At this time we had four donkeys and the mules' loads were much reduced. It was said that they were suffering from the altitude. The cook fell out at Tuctucocha suffering acutely from mountain sickness and went back to Yauli to rest and recover.

The Continental Divide always sounds romantic. I had climbed to it twice before and set up a third time on a point 16,300 feet above sea-level near Ticlio, a station on the Central Railway. Mount Meiggs, a conical hill commanding a splendid prospect, is named after the engineer who built the line in the 'seventies. To the east lies a glaciated tributary of the Tauli with a comb of rock teeth along its northern side. West and north is the edge of the basin of the Rimac which waters Lima. In this the curving railway and the tortuous motor road add an artificial touch to the wild natural forms. Reds, browns, greys, and whites are provided by the rock formations, to which the glacial lakes add touches of blue and green. The tremendous Rimac gorge develops to the south-west, and its shoulders yield overlapping profiles indicating the former extent of the table-land which the river gashes. Clouds unfortunately obscured essential points and a good resection was not obtained. A snowstorm interfered with work and sent us back to camp early, thankful that for once, as there had been no move, we knew its whereabouts. Camp was often otherwise rather hard to find and sometimes was not quite where we expected to find it. To make it conspicuous we had green tents which showed up well against the prevailing yellow and as a further precaution we carried a red fly to provide stronger contrast. With our untractable labour however it was too much trouble to erect this as a flag above camp and so we often resorted to following the tracks of the mules. A snowstorm taking us on the move was doubly troublesome, for it reduced visibility to a few yards and obliterated the spoor.

The village of Yauli is an old mining camp standing on the side of the wide glacial valley into the floor of which the river is now entrenched in a narrow gorge, in places little more than a chain of pot-holes. There are the remains of an old smelter and other mining works, but apart from the public baths, built to profit from a tufa and sinter-building warm sulphur spring, which are well patronized, the place is all but derelict. The working capital of the Department of Yauli is now Oroya, where the Sub-Prefect has his office close to the administration of the Cerro de Pasco Copper Corporation. We had promised to pay our men up to date at Yauli and we did. Next morning, September 3, every man except the cook had gone. We should have retained a small part of their pay until the survey ended.

Our work was progressing along both sides of the Yauli valley, down which camp was moved in easy stages. To get up high enough for map-making from river-level meant a stiff climb each day, but we were fitter than our mules, and peons were changing so frequently that we had little consideration for their

view that a climb of 3000 feet after breakfast was rather too much. Fragments of the pampa were preserved on top, although near here there is a slight regional tilt downstream. This high ground does not show signs of ice action, but the valley below is ice-cut, suggesting that the ice was centred round the mountain nuclei and was not a universal ice-sheet even at the time of maximum glaciation. Youthful drainage, developed almost according to the text-books, occurs on slopes a few miles east of Oroya. A very gentle sloping sheet of limestone is covered here by beds of red shale, forming an impermeable cover from which the water has run off and dug a pattern like the veins in a leaf. Occasionally swallow holes were observed on the pampa. One lies near the ruins between Marco and Pomacancha, and another on the left bank of the Mantaro a few miles north-west of Chacapalpa. Springs emerging from the base of some of the limestone cliffs have deposited fine sheets of tufa; they are common above the sandstone foundation exposed along the Mantaro, Yauli, and Huay Huay rivers. Close to Saco advancing palls of tufa let down on both sides of the canyon of the Yauli river have met and serve as a foot-bridge.

Oroya, standing at the junction of two rivers, is the site of the smelter which treats the ore from Cerro de Pasco to the north-west and three large mines to the south-west. A smelter since it treats sulphides means fume, which carries other oxides besides sulphur and makes the atmosphere very like that in Oldbury on a still day in 1915. The effect of this on the countryside is striking. Around Oroya itself all vegetation has been killed off and the earth is bare. The sturdier and very thorny plants persist on the naked hillsides as the distance from the town increases, and the growth to the untrained eye between hills, say, 5 miles away and 50 miles away at the same height and having the same exposure is hard to differentiate. But animals feeding on them will perceive a difference. Llamas seem to be as immune to sulphur and arsenic as are donkeys, but sheep are soon affected. Even up to 30 miles it is said that lambs are paralysed owing to products of the fume. This scourge accounts for the many broad acres held by the mining company. All their neighbours made claims for damage when the smoke nuisance started, and many were settled by the company buying up the properties. Those at a distance are now successfully farmed; pedigree sheep and cattle have been imported; a veterinary surgeon who specializes on chemical poisoning is retained; and Scottish shepherds arrange for the lambing at a favourable season instead of haphazard. The influence of the fumes extends to about 30 miles from the smelter and has been the subject of sundry, but never disinterested, treatises, sometimes illustrated by interesting maps.

The Heights of Oroya lie north-east of the town and run 40 miles from north-west to south-east. The former plateau between the Continental Divide to the west and the Eastern Cordilleras can be easily detected from here. The clearest day of the season was October 17, and from the Heights that day one could look into the sun north-east and see what appeared to be a gentle plain running between the viewpoint and the skyline dominated then by the triple peaks of Yuracmayo. In the other direction a neighbouring ridge obliterated the ditch in which the Mantaro runs and again the landscape recalled a rolling plain. When imagination has filled up the scalloping gorges to the level of the present shoulder beyond the Western Cordilleras, this plain runs

on another 40 miles to the west. From this plateau 100 miles wide the Central Andes are sculptured by rapid marginal erosion after very recent uplift to a height of about 15,000 feet. Only in the central part has the geological structure strongly influenced erosion.

The motor road crosses the Heights of Oroya at about 14,000 feet and at once enters the basin of the predatory Tarma river which it follows until it is entrenched 6000 feet below the plateau-level at Palca. Above 12,000 feet only the thin grass of the pampa flourishes, and peculiar spiny plants. Below that level trees grow and increase in numbers for the next 2000 feet. Gardens are cultivated and carrots grown for the Lima market. Tarma is set attractively in this valley where a tributary joins it from the south-east. I first saw it in 1925 at the end of the wet season when all the colours were alive. The gum trees provided delicate shades of green with which mingled reds and pinks of the tiled roofs and the white and yellows of the walls. The whole was set against the background of reds and yellows of the mountain shoulder. Tarma is blessed with a good climate, a freshwater supply, and temperate and tropical produce brought to a Sunday market, along with knitted ware and coarse-woven blankets. The dresses favoured by the women are nothing if not bold in colour; the men make a sorry contrast, dressing more and more in the serviceable but dull American mass-produced dungarees. Tarma's market has not the fame of that at Huancayo, but as a spectacle it is much the same. Life is easy, and many a youth seems to do little more than stroll about or sit in the plaza, where a loud speaker relaying a broadcast from Lima replaces the band which used to be the pride of every self-respecting town.

With our mules paid off we could no longer work as a party. Since the outbreak of war Donald had been anxious to be completely free and went off on his own. Weir left for Palcomayo to map as much as he could cover from there. He worked long days, helped by an enthusiastic landlord and a resolute peon, and covered a great deal of country on both sides of the valley. Kearny quartered himself at Huacapistana on the road leading to Chanchomayo in the Amazon forest and made a map on the very edge of the jungle belt. We still had two animals of our own; Campbell rode one and nursed the other, on to which our beds were packed, and we set off to see more of the Ricran valley and try to map up to Yuracmayo. Almost miraculous luck permitted me to accomplish this. We stayed one night in Sacas and moved through mist and rain to Ricran next day. A ruined town stands here poised on a limestone crag nearly 1500 feet up from water. In Ricran the headman was an active friendly person. He allowed us to sleep in his office in the town hall, and having seen us installed he worked on late with all the males of the village making adobe bricks with which to build a new school. This method of contributing labour towards public works seems to work well. Next day Campbell took the kit to Hacienda Maco, where we were hospitably entertained for two nights. I returned to the north-eastern heights although the day seemed to promise mist and rain. The clouds however suddenly dispersed to the north-east, revealing the peaks of Yuracmayo within range, and time just permitted of their mapping before the thunderstorm swept down. It snowed for two hours but cleared later, enabling me to extend the map step by step to Maco.

Maco proved to be an attractive farm standing on a knoll about 400 feet above the river and 11,800 feet above sea-level, encircled by green fields of alfalfa and sheltered by eucalyptus trees, an oasis of green amidst the yellow hills. Irrigation and fencing have produced adequate food for stock improved by interbreeding and giving good milk. I was able to fill in a large area from the hills 2500 feet above Maco to the north-west, but this was the last day of decent weather on this circuit. Next day we moved on to Queta, a big sheep farm farther north-west. We fixed it and the neighbouring village of Tapo, but mist settled down early at 12,500 feet obscuring all my points. Near here a few humming birds appeared at 11,500 feet above sea-level, which is just about the highest point where shrubs and the insects they bring can survive. Through Mr. Whitten's kindness I visited Tapo in better weather and was able to round off this mist-shrouded area comparatively easily in October. Here one can stand on top of a ridge which conforms with its neighbours to reveal its ancestry as a part of the old plateau, and yet look down the steep soil-denuded slopes into the valley of the Tarma 6000 feet below.

By Señor Pascual Carpena's generosity in hospitality and transport I was able to add a broad strip on the west of Weir's map near Palcomayo. The village of Chancha stands on the lower of two enormous terraces of tufa spread between limestone cliffs on the west and the boulder-strewn ridge of granite to the east. Its principal industry until recently was cultivating onions for the Tarma market, but the discovery that a neighbouring hill of yellow sand was partly high-grade gold ore brightened the outlook considerably. Lead mines had been worked in a desultory fashion for some time and there are extensive workings within 2 miles of the town which have been derelict for years. The discovery of this gold has accelerated road building to connect Chancha with the Cerro de Pasco Railway near Tilarnioc, and from this road I was able to cover much of the watershed between the Mantaro and Tarma basins. The slopes traversed by the road above Chancha are cultivated and a heavy crop of well-ripened grain was standing still uncut in October, owing to abnormal weather; the grain is normally harvested in August.

Wide aprons of tufa have had a remarkable effect on the topography. Gorge scenery develops below them, but above them the pampa extends as the undulating country which characterizes the plateau everywhere. In the next tributary feeding the Tarma however there are no tufa deposits and it is vigorously cutting back into the mature rolling hills amongst which gentle open valleys gather the drainage to the Mantaro. Farther north the big lake of Junin stands within the Mantaro drainage, and beyond it the snow-clad range of the White Cordilleras can be seen. Miller mapped part of this range in 1927 and more recently Dr. Hans Kinzl has produced a beautiful map of the range around its highest peak, Huascaran, which his party scaled for the first time in 1939.

The doom of this pampa country will not be delayed for long in a geological sense unless there is some sudden change of climate. The watershed is moving west and will soon work back to the Western Cordilleras, ravaging the pleasant high upland in the process.

This country forms the north-western extension of the Heights of Oroya, in which district much remained to be done. Mr. Whitten carried me off to

Cachichachi, and from the shelter of that friendly hacienda some of the south-eastern part of the gap was filled. There is a large plain at 13,200 feet a few miles north-west of the farm near which partridges and pipits, a large yellow bird like a jay, and flights of finches were often disturbed. In the bog we saw snipe, and a fawn-coloured plover with a pattern of white feathers. This plain was evidently a lake, but has been drained within the last few years and now gives pasture for sheep. The scenery on the Heights is dominated by many small peaks of white limestone, their shape depending on the very contorted attitude of the rock in these parts. None stand more than a few hundred feet above the general level, but are impressive at close range. These are the highest points on the Heights and usually serve as the watershed, but in a few places the south-western drainage to the Mantaro has cut across to their north-eastern side. Twice in these uplands I saw bees above 14,000 feet, with a chestnut-brown thorax like the wild ones which used to be common in the west of Scotland before it became industrialized. Butterflies are rare and soberly coloured. Many of the animals carried ticks, but none was picked up by any member of the party. One small scorpion visited our tents. House flies never annoyed us though they become a pest much lower down, and the one dangerous parasite, the louse which carries typhus, we were lucky to avoid.

The remainder of the ridge was tackled from the motor road between Tarma and Oroya by using the bus that runs daily between these towns. It is noteworthy that transport between points on a regular route is remarkably reasonable, in contrast to a special charter which is prohibitively expensive.

The final piece of work was to map from Morococha across the Continental Divide down the Rimac valley as far as Rio Blanco. It provided one with a final view of the magnificent sights in the Western Cordilleras and the new and only experience of a south-west wind during my stay in Peru. As soon as I was well between the walls of the Rimac valley this wind began to blow strongly upstream. It was in the afternoon and it seems possible that it may be related to a diurnal land and sea breeze. I had no opportunity of observing whether it is a normal phenomenon or not. The journey ended for me at Rio Blanco railway station, where I established my last point before mounting the afternoon train for Lima.

The main geographical result of this journey in the Andes has been the map of 2500 square miles, most of which had not been covered before. It emphasizes once more that the Andes in Central Peru are a range sculptured from a recently elevated plateau. The Eastern and Western Cordilleras are no more than strips along the table-land, below which bodies of rather harder or resistant rocks were lying which have been etched out in the course of the early stages of a cycle of erosion. Glaciation has played an active part in shaping all the higher peaks. The whole region was never covered by an ice-sheet, although at one time the extent of the glaciers was much greater than it is now.

The country has never fully recovered from the savagery of the Spanish conquerors and its greatest need to-day is more of the working class. Mechanized transport is materially affecting the life of most of the people and some of their habits are undergoing rapid changes. It is also bringing fresh tracts of healthy country within reasonable reach of the settled parts. It seems to me

that only when there is abundant immigration of working stock will Peru reach the peak to which natural wealth and a benevolent climate have destined her.

DISCUSSION

Before the paper the CHAIRMAN (Professor KENNETH MASON) said: It falls to my lot to introduce our lecturer, Dr. Harrison. Many of the Fellows of the Society have heard him lecture in this hall on other occasions, and in 1939 he received the Gill Memorial. He was, I believe, the first to show a geographical film here. Dr. Harrison has carried out a great deal of exploration during the past twenty years, both in Iran and in the Andes. This afternoon he is going to describe his recent expedition to the Central Andes of Peru.

Dr. Harrison then read the paper printed above, and a discussion followed.

Mr. MACKEHENIE: My country has been of interest to Englishmen for centuries past. Nearly four hundred years ago Sir Francis Drake went to Peru on an expedition which I believe was one of the great events in the history of England. You have seen on the screen and doubtless admired the beauty of Peru, and obviously Dr. Harrison has made a very interesting and valuable survey. It is easy to say how beautiful a country is, but that does not imply that those who travel in it do not suffer hardships. The lecturer certainly did suffer them, and he therefore shares my admiration with Sir Francis Drake. A President of this Society, Sir Clements Markham, whose memory is dear to me, also visited Peru when he was a young man and later wrote many interesting books on the country. He was on very friendly terms with the Indians, and I take it that Dr. Harrison was also on good terms with them. They are simple people, living simple and pleasant lives in their own way. Drake visited Peru for the sake of glory and for money. I congratulate Dr. Harrison because he went there for neither: he underwent the hardships of travel in Peru merely for the sake of science.

Mr. M. H. DONALD: I feel that Dr. Harrison, my companion, has explained our journey so thoroughly as regards the Cordillera that there is little I can add. We happened, after the outbreak of war, to spend two or three nights camping in some delightful and peaceful upland valleys amid the snow peaks. So peaceful was it that probably each of us asked ourselves why we were returning to troubled Europe at all.

War having broken out, we could not sail as we intended at the beginning of October, and thus we had three or four weeks to use up. Dr. Harrison spent the time in filling in what he termed "holes in the map." I visited another part of Peru. This afternoon you have seen slides which have mostly depicted the highlands, but on the eastern side of the Andes there is a vast area of forest through which flow the rivers that eventually join the Amazon. I was invited by Mr. Morkill, General Manager of the Central Railway, which is operated by the Peruvian Corporation, to spend a few days on the Corporation's fruit-growing estate, known as the Perene Colony. This covers a vast area of tropical forest, only a relatively small proportion of which has as yet been cleared and developed for the growing of bananas, oranges, coffee, and other tropical produce.

I was also fortunate on reaching Perene Colony to meet a doctor who was carrying out tropical research for the Peruvian Government. He was about to set out on a fortnight's journey into the interior to examine certain Indians for diseases from which they were known to suffer, also to measure their heads, the width of their noses, and so on, and generally to take note of their characteristics. I felt somewhat doubtful about accepting his invitation on seeing the type of

craft in which we were to travel down the rivers and through the rapids. However, it was a beautifully shaped 30-foot dug-out and was most efficiently handled by our five Indians. The doctor and I put some food in a tin box, some spare clothing in our ruck-sacks, and set out. We travelled by canoe for three days and came to rapids extending for over a mile which were impossible to negotiate. Here we left the canoe and walked along trails in the forest for four days, to our farthest point. The jungle was exceedingly dense in places, and our leading Indian went ahead armed with a large machete to cut away the thick growth. Although we had with us men who were supposed to be familiar with the route, it was disconcerting to see them halt now and then, and hold long consultations as to which was the correct way. I should say that these Indians of the jungle, the Chunchus, were exceedingly honest and much more pleasant as attendants than those Dr. Harrison and I had with us in the highlands of Peru. When we settled for the evening it was amusing to watch them turning out our ruck-sacks and trying on our boots and clothing. They however replaced everything carefully, which is more than our highland porters were accustomed to do.

I am not an entomologist, but I could not help being impressed with the insect life. By day along the river banks there were swarms of magnificent butterflies. In the evenings at the huts there were often very large spiders crawling about, also peculiar black beetles over an inch in length, which had two bright luminous spots near their eyes. They looked like toy motor cars with headlights as they moved about at night. There were also snakes, some of a poisonous kind.

The Indians do not have villages, but reside in groups of three or four huts in clearings in the forest, and these clearings are sometimes far apart. The food which we had taken with us was running rather short, but the doctor used to tell me chaffingly that we would not starve as we could always live on the native fare. The Indians eat chiefly yucca root, which I believe is what we call in England tapioca. They warm the root in the ashes of a log fire, but it is dry and uninteresting stuff. They also make a drink from yucca by a somewhat unpleasant method. The women mush up some of the root, put it in their mouths, chew it for a while, and then take it out and place it in a wooden trough. A cover is put on the trough and it is left for a few days; fermentation takes place, the saliva having started the process. Later, when water is added, an exceedingly heady drink is produced. On halting one morning at a group of huts, one of our porters got hopelessly drunk on it in twenty minutes. Nevertheless it is most refreshing, and it was customary as we approached a group of huts for an Indian to meet us with a wooden bowl containing the liquid. Needless to say we were careful only to take a little for the sake of complying with the ceremony.

When after a fortnight's travel we arrived again at the edge of the forest we called at a monastery. The building was but a single-storey house built of wood, in which resided a bishop and two or three monks. They received us kindly and gave us an evening meal and a night's lodging, which was most welcome. The following day they secured horses for us from a neighbouring hacienda and we rode into more hilly country by Satipo to Santa Ana. After a night here we went on by a Government Roads Department car, a nine-hours' run, to Concepción in the valley of the Mantaro. The road between Santa Ana and Concepción ascends twice to an altitude of over 15,000 feet.

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EXPEDITION TO ELLESMERE ISLAND, 1937–38

DAVID HAIG-THOMAS

Evening Meeting of the Society, 6 March 1939

A SMALL expedition, consisting of myself, John Wright, and Richard Hamilton, spent a year in north-west Greenland and Ellesmere Island. My companions were successful and brought back some extremely good results, and I too made certain small discoveries which are perhaps worth recording.

The expedition arrived at Thule in north-west Greenland in August 1937. Here we were interested to note that the flowers were much further advanced than those we had seen in west Greenland, possibly due to the earlier arrival of the midnight sun. We landed our equipment, and while Richard Hamilton prepared for the winter, John Wright and I decided to go north by boat to make a depot for sledging in the spring. So we went on to Robertson Bay in the Danish ship which had brought us to Thule and then continued north along the coast in an 18-foot boat with an outboard engine. We called at Etah and visited the hut built by the Oxford Ellesmere Land Expedition in 1935. We were astonished to see strips of cinematograph film below high-tide mark which had not been washed away. But farther north the ice was impossible and we returned to Robertson Bay. A few days later we made a second journey into Smith Sound. Walruses and seals were very plentiful and there were great quantities of glaucous gulls and millions of little auks. Unfortunately the ice again made a crossing to Ellesmere Island impossible, and after we had been imprisoned in the ice for some time and only just missed being crushed, we decided to give up the attempt and landed our depot of pemmican oil and fresh walrus meat on the Greenland coast near Cape Hatherton.

So we returned to Thule, which we reached thanks to John Wright's perseverance in repairing the outboard engine and his knowledge of seamanship which kept us afloat. Once we were almost blown out to sea; another time we narrowly missed being wrecked on a part of the coast whence it would have been very difficult to get either to Thule or any other Eskimo settlement. But perhaps our narrowest escape was when an iceberg floated in on top of us while we were sleeping at anchor in a sheltered bay.

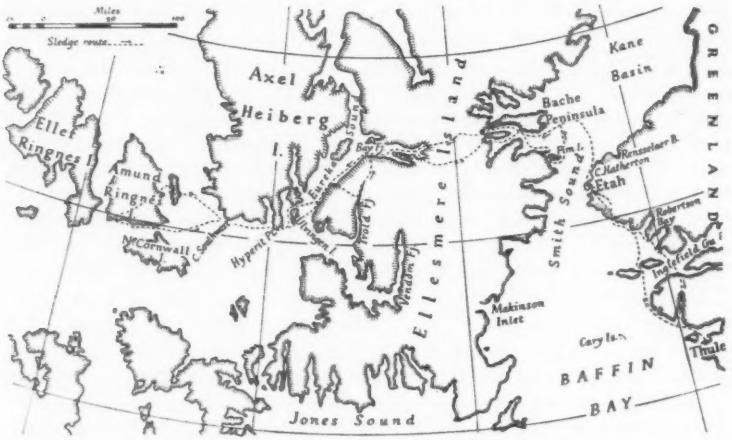
We arrived at Thule on September 3 to find Richard Hamilton had made everything ready for the winter and was hard at work with his observations. Meanwhile Wright set out to make the most use of the little sun that remained to survey the fjord, land, and nunataks around Thule and to fix with his theodolite marks on the glaciers to record their movements.[1]

The winter at Thule was extremely pleasant, with very little wind and not much snow. At one time we heard on the wireless that the snow was deeper in Spain than in Greenland. All three of us kept in excellent health, due largely to the fresh seal and walrus meat that we ate and to the still weather

[1] An account of this work has been published in the *Medd. om Grønland* 125 (1939) pt. 3, p. 42.

which allowed us to spend so much of the winter hunting, skiing, and sledging.

After Christmas two short sledge journeys were made. Wright went north to Robertson Bay to buy skins for clothes, while I visited Melville Bay to get notes on the habits of polar bears in that district. As soon as the sun returned we made preparations for the exploration of Ellesmere Island. We found it necessary to change our plans very considerably, for we had been counting on a depot of supplies there; the Greenland Administration had revised their earlier decision and now gave permission for an Eskimo to accompany the expedition; and we had received a wireless message from J. M. Wordie that he had left a supply of walrus meat in the abandoned Police Hut at Bache Peninsula. We decided to make two parties: Hamilton and Wright should survey southern Ellesmere Island, thereby making certain of some useful



Sketch-map showing route followed by Haig-Thomas and Nukapinguaq

scientific results, while I was to cross Ellesmere Island with Nukapinguaq on a wild goose chase to investigate an Eskimo rumour of a prehistoric skeleton, and, by noting carefully the tracks of all the animals I saw, to discover if there were definite lines of migration.

Our journey to Etah was uneventful. Here we met an American expedition led by C. J. MacGregor, who welcomed us with true American hospitality. We left Etah on March 18, and over the first half of Smith Sound sledging was easy. I thought the open water stretched considerably farther north than in 1935. The edge of the pack-ice was in the form of an arc from Rensselaer Bay to Pim Island. The last part of the crossing to Bache Peninsula was over very old polar pack covered in deep snow, and although Nukapinguaq and I had sixteen dogs and only a few hundred pounds on our Greenland sledge, which was fitted with broad adjustable Nansen runners, we could accomplish only a very small daily mileage with great physical effort to ourselves. In consequence we were soaked with perspiration and at night suffered a great

deal from the cold, though the thermometer was not very low, the average temperature being about —30° F. At last the Police Hut was reached and our clothes dried by a walrus blubber fire. In 1938, but not on my former visit in 1935, Arctic hares and lemmings were very numerous and the sides of the fjords were dotted with their tracks. On our arrival in Ellesmere Island there were no ravens. I believe that during the winter months and early spring they are entirely parasitic to the Eskimo, and their food during this time is what they can steal from the Eskimo meat caches and the dogs' dung, which they find by following the sledge tracks.

We crossed Ellesmere Island by the Flagler–Bay Fjord crossing. Here there was considerably less snow than in 1935, and again it was extremely exhausting sledging across some 40 miles of rocks. We found a large herd of musk-oxen; they were extremely tame and would only move out of the way when we cracked our whips on their noses; then they made off to the north, their long hair brushing the snow off the rocks. The glaciers which hung down on the south side of the valley seemed to me to be less formidable than two years before. The ends of the glaciers were very rounded and not much ice had fallen off. During this crossing we recorded the lowest temperature on the journey of —52° F.

There is one point where the valley which connects Bay Fjord with Flagler Fjord is blocked by a glacier fed from the southern ice-cap, and we had to make a considerable detour up the northern slopes of the valley. The mountains to the north were sharp and pointed, and I estimated their height to be 5000 or 6000 feet. This estimate was also shared by a member of MacGregor's expedition who a few weeks later flew over them.

Bay Fjord, as in 1935, was beautifully smooth. I believe that it always is, for the tides are so small that often the ice-foot is hardly noticeable. To the south the hills are low and rolling, and a sledge could be taken inland almost anywhere, while to the north, though the land is low near the fjord itself, the hills behind are high. The tracks of the animals in the fjord were completely haphazard except for the reindeer which were coming from the west: lemmings, foxes, hares, and wolves seemed to have crossed in every direction. There were far more tracks than I had seen in 1935. Arctic wolves were very common; usually we saw them in pairs; they would run up on each side of the sledge some 30 or 40 yards away, and then almost immediately go bounding off to disappear amid a flurry of snow in the distance. Like polar bears they look very yellow when the sun is not shining on them.

The sides of the fjord were completely devoid of musk-oxen. At this I was very surprised, for Dr. Humphreys and I had seen so many in May 1935, but Nukapinguaq says this is always the case early in the year and that they are rarely found close to the sea-ice. For the edge of the sea-ice is an Arctic highway for wolves and bears, and no doubt the musk-oxen feel safer inland. Later in the spring however, and especially in the summer when the ice has broken up, the musk-oxen are found close to the sea, possibly to get salt. But Nukapinguaq thinks that again it is for safety, for they can then be attacked by wolves from one side only.

Bear tracks were very numerous, and we found seventeen seal holes which had been broken into by one bear without catching a seal. At the junction of

Bay Fjord and Eureka Sound we saw eight bears in one day and killed two, and while sledging down Eureka Sound we passed a bear travelling the same way as ourselves; although we shouted and hallooed and passed upwind of him he only bothered to give us a casual glance. We left him far behind and eventually all we could see was a cloud of steamy breath on the horizon.

Eureka Sound, unlike Bay Fjord, was windswept and for many miles Nukapinguaq and I could both sit on top of our load on the Greenland sledge, and it ran so easily that the dog-lines were not even taut. On the Ellesmere Island side the hills are terraced, with steep shale slopes, though there were one or two places where a sledge could have been taken inland. On the Axel Heiberg Island side there is the most beautiful scenery: high peaks and glaciers with only small shale slopes between them and Eureka Sound itself. As in Bay Fjord, the tracks of the animals were completely haphazard except for the reindeer which were heading north.

We sledged between Ulvingen Island and Axel Heiberg Island. Here again there were a great many bear tracks, and near the southern end of the island we were awakened by the barking of our dogs and, to our amazement, on opening the door of the tent, there were five Arctic wolves snarling at the dogs. They were apparently four dog wolves and a bitch, and I was surprised to see how large the wolves looked standing beside our dogs. Even my biggest dog, which weighed 105 lb., looked small beside the wolves, though he was about the size of the bitch. Just what was going to happen we were not quite sure; our sixteen dogs were straining at their lines in a half-hearted fashion. Then two wolves approached within a few feet of them and they stopped barking. They remained nose to nose like strange dogs that meet in the street. The hairs on the wolves' backs stood erect, their lips were drawn back to show their teeth. Then the two wolves leapt at the dogs, but very soon were tripped up by the dog-lines, which of course they did not understand, while the three other wolves stood a few yards off watching the fight. Nukapinguaq shot at one which was watching, and at the sound of the shot all of them, including the two that were fighting with the dogs, ran away. Then one stopped, spun round, and fell dead. The remaining wolves also stopped. The largest, which was probably the leader of the pack, approached the dead wolf, which happened to be the bitch. He walked in funny short steps with his legs straight and stiff and sniffed at the dead wolf. He then bounded away and stood with the hairs on his back erect. He circled round the dead animal two or three times. I watched him through my glasses, and although I could hear nothing, I think he was whining. Then suddenly they all turned and went leaping away, leaving the dead wolf on the ice.

At Hyperit Point we killed our third bear, as meat was getting short. Here Nukapinguaq found in a cairn a message from Sergeant Joy of the R.C.M.P. Unlike Eureka Sound the south coast of Axel Heiberg Island was deep in snow. We divided the dogs and I went ahead using my dogs pulling centre-trace and dragging the bear-skin with parts of the load, thereby making a good trail for Nukapinguaq and the sledge. I was surprised to find that the south coast of Axel Heiberg Island, which appeared to run fairly straight to Cape Southwest, did not really do so, for we crossed a large bay about 15 miles across and 10 miles deep. How this bay had remained undiscovered

craft in which we were to travel down the rivers and through the rapids. However, it was a beautifully shaped 30-foot dug-out and was most efficiently handled by our five Indians. The doctor and I put some food in a tin box, some spare clothing in our ruck-sacks, and set out. We travelled by canoe for three days and came to rapids extending for over a mile which were impossible to negotiate. Here we left the canoe and walked along trails in the forest for four days, to our farthest point. The jungle was exceedingly dense in places, and our leading Indian went ahead armed with a large machete to cut away the thick growth. Although we had with us men who were supposed to be familiar with the route, it was disconcerting to see them halt now and then, and hold long consultations as to which was the correct way. I should say that these Indians of the jungle, the Chunchus, were exceedingly honest and much more pleasant as attendants than those Dr. Harrison and I had with us in the highlands of Peru. When we settled for the evening it was amusing to watch them turning out our ruck-sacks and trying on our boots and clothing. They however replaced everything carefully, which is more than our highland porters were accustomed to do.

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Evening Meeting of the Society, 6 March 1939

A SMALL expedition, consisting of myself, John Wright, and Richard Hamilton, spent a year in north-west Greenland and Ellesmere Island. My companions were successful and brought back some extremely good results, and I too made certain small discoveries which are perhaps worth recording.

The expedition arrived at Thule in north-west Greenland in August 1937. Here we were interested to note that the flowers were much further advanced than those we had seen in west Greenland, possibly due to the earlier arrival of the midnight sun. We landed our equipment, and while Richard Hamilton prepared for the winter, John Wright and I decided to go north by boat to make a depot for sledging in the spring. So we went on to Robertson Bay in the Danish ship which had brought us to Thule and then continued north along the coast in an 18-foot boat with an outboard engine. We called at Etah and visited the hut built by the Oxford Ellesmere Land Expedition in 1935. We were astonished to see strips of cinematograph film below high-tide mark which had not been washed away. But farther north the ice was impossible and we returned to Robertson Bay. A few days later we made a second journey into Smith Sound. Walruses and seals were very plentiful and there were great quantities of glaucous gulls and millions of little auks. Unfortunately the ice again made a crossing to Ellesmere Island impossible, and after we had been imprisoned in the ice for some time and only just missed being crushed, we decided to give up the attempt and landed our depot of pemmican oil and fresh walrus meat on the Greenland coast near Cape Hatherton.

So we returned to Thule, which we reached thanks to John Wright's perseverance in repairing the outboard engine and his knowledge of seamanship which kept us afloat. Once we were almost blown out to sea; another time we narrowly missed being wrecked on a part of the coast whence it would have been very difficult to get either to Thule or any other Eskimo settlement. But perhaps our narrowest escape was when an iceberg floated in on top of us while we were sleeping at anchor in a sheltered bay.

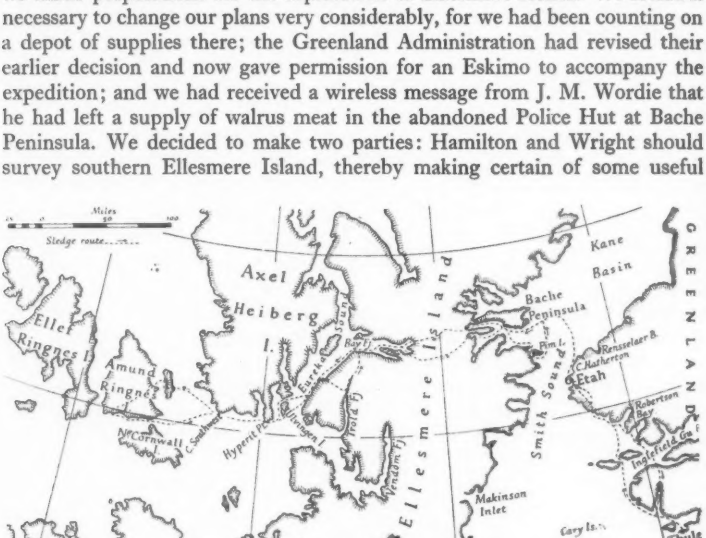
We arrived at Thule on September 3 to find Richard Hamilton had made everything ready for the winter and was hard at work with his observations. Meanwhile Wright set out to make the most use of the little sun that remained to survey the fjord, land, and nunataks around Thule and to fix with his theodolite marks on the glaciers to record their movements.[1]

The winter at Thule was extremely pleasant, with very little wind and not much snow. At one time we heard on the wireless that the snow was deeper in Spain than in Greenland. All three of us kept in excellent health, due largely to the fresh seal and walrus meat that we ate and to the still weather

[1] An account of this work has been published in the *Medd. om Grønland* 125 (1939) pt. 3, p. 42.

which allowed us to spend so much of the winter hunting, skiing, and sledging.

After Christmas two short sledge journeys were made. Wright went north to Robertson Bay to buy skins for clothes, while I visited Melville Bay to get notes on the habits of polar bears in that district. As soon as the sun returned we made preparations for the exploration of Ellesmere Island. We found it necessary to change our plans very considerably, for we had been counting on a depot of supplies there; the Greenland Administration had revised their earlier decision and now gave permission for an Eskimo to accompany the expedition; and we had received a wireless message from J. M. Wordie that he had left a supply of walrus meat in the abandoned Police Hut at Bache Peninsula. We decided to make two parties: Hamilton and Wright should survey southern Ellesmere Island, thereby making certain of some useful



Sketch-map showing route followed by Haig-Thomas and Nukapinguaq

scientific results, while I was to cross Ellesmere Island with Nukapinguaq on a wild goose chase to investigate an Eskimo rumour of a prehistoric skeleton, and, by noting carefully the tracks of all the animals I saw, to discover if there were definite lines of migration.

Our journey to Etah was uneventful. Here we met an American expedition led by C. J. MacGregor, who welcomed us with true American hospitality. We left Etah on March 18, and over the first half of Smith Sound sledging was easy. I thought the open water stretched considerably farther north than in 1935. The edge of the pack-ice was in the form of an arc from Rensselaer Bay to Pim Island. The last part of the crossing to Bache Peninsula was over very old polar pack covered in deep snow, and although Nukapinguaq and I had sixteen dogs and only a few hundred pounds on our Greenland sledge, which was fitted with broad adjustable Nansen runners, we could accomplish only a very small daily mileage with great physical effort to ourselves. In consequence we were soaked with perspiration and at night suffered a great

deal from the cold, though the thermometer was not very low, the average temperature being about —30° F. At last the Police Hut was reached and our clothes dried by a walrus blubber fire. In 1938, but not on my former visit in 1935, Arctic hares and lemmings were very numerous and the sides of the fjords were dotted with their tracks. On our arrival in Ellesmere Island there were no ravens. I believe that during the winter months and early spring they are entirely parasitic to the Eskimo, and their food during this time is what they can steal from the Eskimo meat caches and the dogs' dung, which they find by following the sledge tracks.

We crossed Ellesmere Island by the Flagler–Bay Fjord crossing. Here there was considerably less snow than in 1935, and again it was extremely exhausting sledging across some 40 miles of rocks. We found a large herd of musk-oxen; they were extremely tame and would only move out of the way when we cracked our whips on their noses; then they made off to the north, their long hair brushing the snow off the rocks. The glaciers which hung down on the south side of the valley seemed to me to be less formidable than two years before. The ends of the glaciers were very rounded and not much ice had fallen off. During this crossing we recorded the lowest temperature on the journey of —52° F.

There is one point where the valley which connects Bay Fjord with Flagler Fjord is blocked by a glacier fed from the southern ice-cap, and we had to make a considerable detour up the northern slopes of the valley. The mountains to the north were sharp and pointed, and I estimated their height to be 5000 or 6000 feet. This estimate was also shared by a member of MacGregor's expedition who a few weeks later flew over them.

Bay Fjord, as in 1935, was beautifully smooth. I believe that it always is, for the tides are so small that often the ice-foot is hardly noticeable. To the south the hills are low and rolling, and a sledge could be taken inland almost anywhere, while to the north, though the land is low near the fjord itself, the hills behind are high. The tracks of the animals in the fjord were completely haphazard except for the reindeer which were coming from the west: lemmings, foxes, hares, and wolves seemed to have crossed in every direction. There were far more tracks than I had seen in 1935. Arctic wolves were very common; usually we saw them in pairs; they would run up on each side of the sledge some 30 or 40 yards away, and then almost immediately go bounding off to disappear amid a flurry of snow in the distance. Like polar bears they look very yellow when the sun is not shining on them.

The sides of the fjord were completely devoid of musk-oxen. At this I was very surprised, for Dr. Humphreys and I had seen so many in May 1935, but Nukapinguaq says this is always the case early in the year and that they are rarely found close to the sea-ice. For the edge of the sea-ice is an Arctic highway for wolves and bears, and no doubt the musk-oxen feel safer inland. Later in the spring however, and especially in the summer when the ice has broken up, the musk-oxen are found close to the sea, possibly to get salt. But Nukapinguaq thinks that again it is for safety, for they can then be attacked by wolves from one side only.

Bear tracks were very numerous, and we found seventeen seal holes which had been broken into by one bear without catching a seal. At the junction of

Bay Fjord and Eureka Sound we saw eight bears in one day and killed two, and while sledging down Eureka Sound we passed a bear travelling the same way as ourselves; although we shouted and hallooed and passed upwind of him he only bothered to give us a casual glance. We left him far behind and eventually all we could see was a cloud of steamy breath on the horizon.

Eureka Sound, unlike Bay Fjord, was windswept and for many miles Nukapinguaq and I could both sit on top of our load on the Greenland sledge, and it ran so easily that the dog-lines were not even taut. On the Ellesmere Island side the hills are terraced, with steep shale slopes, though there were one or two places where a sledge could have been taken inland. On the Axel Heiberg Island side there is the most beautiful scenery: high peaks and glaciers with only small shale slopes between them and Eureka Sound itself. As in Bay Fjord, the tracks of the animals were completely haphazard except for the reindeer which were heading north.

We sledged between Ulvingen Island and Axel Heiberg Island. Here again there were a great many bear tracks, and near the southern end of the island we were awakened by the barking of our dogs and, to our amazement, on opening the door of the tent, there were five Arctic wolves snarling at the dogs. They were apparently four dog wolves and a bitch, and I was surprised to see how large the wolves looked standing beside our dogs. Even my biggest dog, which weighed 105 lb., looked small beside the wolves, though he was about the size of the bitch. Just what was going to happen we were not quite sure; our sixteen dogs were straining at their lines in a half-hearted fashion. Then two wolves approached within a few feet of them and they stopped barking. They remained nose to nose like strange dogs that meet in the street. The hairs on the wolves' backs stood erect, their lips were drawn back to show their teeth. Then the two wolves leapt at the dogs, but very soon were tripped up by the dog-lines, which of course they did not understand, while the three other wolves stood a few yards off watching the fight. Nukapinguaq shot at one which was watching, and at the sound of the shot all of them, including the two that were fighting with the dogs, ran away. Then one stopped, spun round, and fell dead. The remaining wolves also stopped. The largest, which was probably the leader of the pack, approached the dead wolf, which happened to be the bitch. He walked in funny short steps with his legs straight and stiff and sniffed at the dead wolf. He then bounded away and stood with the hairs on his back erect. He circled round the dead animal two or three times. I watched him through my glasses, and although I could hear nothing, I think he was whining. Then suddenly they all turned and went leaping away, leaving the dead wolf on the ice.

At Hyperit Point we killed our third bear, as meat was getting short. Here Nukapinguaq found in a cairn a message from Sergeant Joy of the R.C.M.P. Unlike Eureka Sound the south coast of Axel Heiberg Island was deep in snow. We divided the dogs and I went ahead using my dogs pulling centre-trace and dragging the bear-skin with parts of the load, thereby making a good trail for Nukapinguaq and the sledge. I was surprised to find that the south coast of Axel Heiberg Island, which appeared to run fairly straight to Cape Southwest, did not really do so, for we crossed a large bay about 15 miles across and 10 miles deep. How this bay had remained undiscovered

Eskimo fishing for gurnard

Spearing Arctic char

Boring with an ivory bow

Inside an Eskimo winter home

by MacMillan and Sverdrup it is difficult to understand. It appeared quite probable by the shape of the hills behind that a large fjord ran into the top of the bay. Perhaps the next sledging party in this neighbourhood might explore the bay with this in mind.

The south coast of Axel Heiberg Island, which in the east had been one mass of sharp-pointed peaks, now gradually flattened out, only to rise again at Cape Southwest itself. It was covered in deep snow, though in places we saw long dead grass sticking out. Probably owing to the snow there were practically no tracks of animals, except those of a herd of musk-oxen which came straight across the sea from the south. We were surprised at the straightness of their tracks on the sea-ice, so unlike their haphazard wanderings over the hills.

At Cape Southwest there was sea-ice frozen on to the cliff face far above us. No doubt in the autumn an enormous floe of old polar ice had been blown by tremendous gales against the cape, had piled itself up to an immense height, and frozen on to the cliff. This could not have happened the previous autumn, for the ice itself was round and showed signs of a summer thaw. At the time I estimated it was 100 yards up the cliff above sea-level.

On the sea-ice below Cape Southwest we found tracks of reindeer which had presumably crossed from Amund Ringnes Island in the early autumn when the surface of the sea-ice was still wet. We climbed the cape and from the top could see a grey-blue line in the distance which we mistook for Amund Ringnes Island. Later we discovered that the land we had seen was a long low island some 15 miles off its coast. We could also see a mountain on Cornwall Island. To the north we could see no signs of Meighen Island, and there seemed to be a better sledging surface south towards Cornwall Island. To the south there was a mirage like a gigantic glacier foot, and although I had the witness of my own eyes, for I had travelled along the coast for the last few days, I could scarcely persuade myself that it was only mirage. On top of Cape Southwest was a covey of ptarmigan. They flew round us like a flock of fantail pigeons and showed no fear. At the cape we left a depot of food, as we had done at Hyperit Point and at the junction of Eureka Sound and Bay Fjord.

We crossed to Cornwall Island and left a message in a cairn beside a message left by Constable Hamilton while searching for the lost Krüger Expedition in 1932. From here we sledged to the south-east corner of Amund Ringnes Island and saw a long low spit of land jutting out into the sea which at first I thought was an island, as MacMillan had observed an island in about that direction; but we now found that what we thought was an island was part of the mainland, merely a long low sandbank sticking out into the sea and not marked on Sverdrup's map. We climbed the hill and from the top thought we could see an island between us and Axel Heiberg Island, but the visibility was poor, for there was a maze of tiny ice crystals falling from the sky. As food was short we decided to return and left a message in a cairn telling of our intentions. Later however we continued along the south coast of Amund Ringnes Island and from a spot near the south-west corner crossed the island in a north-easterly direction. It is low and flat with a little high land in the south, and I think also in the north. It

was mostly covered with snow, though here and there patches of sandy gravel peered out, and everywhere there seemed to be old tide levels. We continually thought we were coming to the sea-ice, only to find that land stretched out beyond; and it was not until we finally came to the tide crack on the east coast that we knew we had reached the sea-ice.

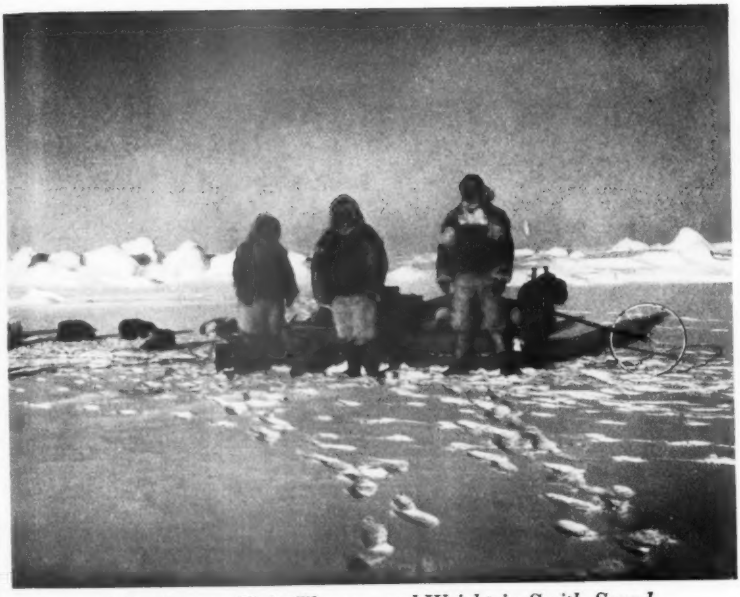
Ahead of us, sticking out of the ice, was an island between us and Axel Heiberg Island. The east coast of Amund Ringnes Island was apparently two large bays with a point in the middle and not the convex curve shown dotted on the chart. We sledged out to the island and again crossed a tide crack. The island seemed to be in the shape of a large banana, though we were unable to see the northern and southern limits. We tied the dogs to an ice-anchor and climbed the highest point, which was in the northern half. This was only a few hundred feet high. From it we could see the tide-crack in the north and a jumble of rough ice that had been pushed on to the shore. I could see Giant's Castle Hill, a mountain on Cornwall Island, and Cape Southwest of Axel Heiberg Island. I now felt perfectly certain that the hills we had seen in the north of Amund Ringnes Island were actually hills and not merely mirage. They were still visible, and I cannot think that a mirage could hang so long in the same place; although it is difficult to understand how they were not seen by Sverdrup's expedition. There were few plants growing on the island: the remains of Arctic poppies and several small saxifrages. We saw the tracks of two reindeer which had crossed in the direction of Axel Heiberg Island, but they were not fresh. We then crossed the island by a small gully which was packed with snow. Any one wishing to sledge across would instinctively choose this route: a few feet to the left we made a cairn with a sleigh stick on top, north of the gully and about in the centre of the island.

Up till now the temperature had almost continually read between −30° and −40° F.; for several days past we had been living on half rations, and now there was barely one meal of bear meat left. We crossed to Cape Southwest to find that our depot of food had been stolen by bears and wolves. However we had a meal of scraped bear-skin soup and fed the rest of the skin to the dogs; then continued non-stop to Hyperit Point, which took over twenty-four hours' sledging. We arrived completely exhausted to find this depot also had been stolen, but luckily for ourselves a bear walked right up to the igloo and was immediately shot.

We spent several days resting and feeding up the dogs which had got very hungry. I made some long tours into Axel Heiberg Island on skis. As far as I could see there was no big ice-cap but a mass of mountains and valleys with glaciers here and there. There seemed to be a good deal of vegetation, and I believe this is where the majority of the greater snow geese nest. We found a musk-ox just killed by wolves and ate the meat, which was delicious.

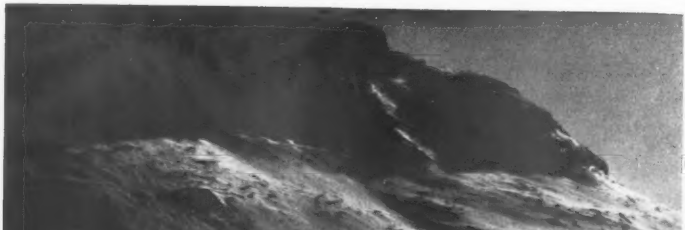
We continued up Eureka Sound, and from there crossed to Trold Fjord on foot. I immediately recognized the fjord to which Dr. Humphreys and I had sledged in 1935.

We continued down Bay Fjord and for four days explored the land to the south, looking in vain for the fossil bones that Nukapinguaq had seen on a sledge journey with Joy. According to Nukapinguaq he and Joy had come

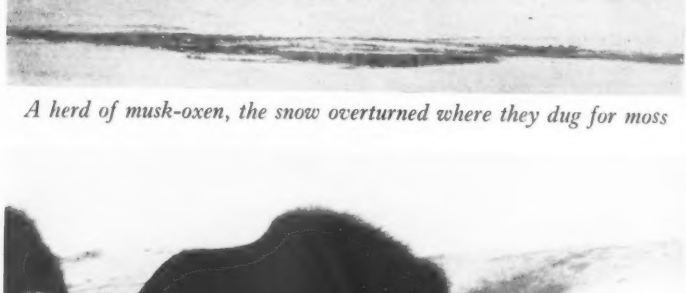


Nukapinguaq, Haig-Thomas, and Wright in Smith Sound

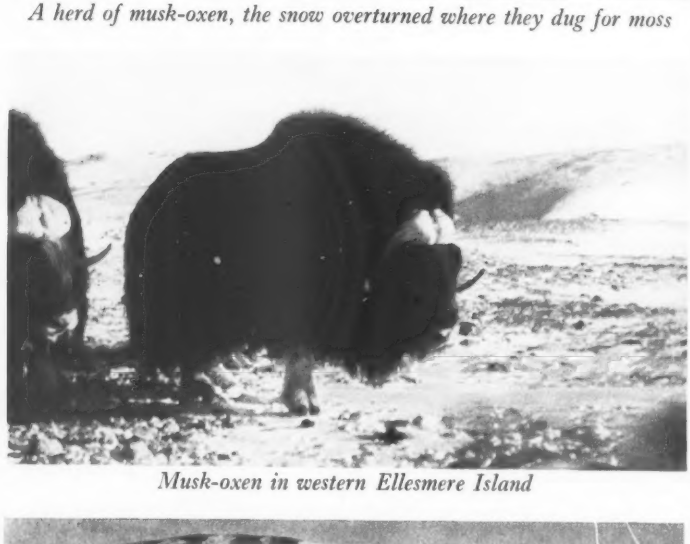
A trial of strength



A herd of musk-oxen, the snow overturned where they dug for moss



Musk-oxen in western Ellesmere Island



Arctic hare in Ellesmere Island

from the Police Hut at Craig Harbour. They were crossing Ellesmere Island from Trold Fjord to Bay Fjord and had seen a strange round mound on the side of a small, dried-up stream. On going to inspect it, they found the fossil bones of a large animal, 20 or more feet long. Its tail was hanging into the valley; its head and feet were still underground. Some of the bones were clearly showing; and in places parts of the body could be seen, though turned to stone. Nukapinguaq also gave me satisfactory reasons why Joy had not reported the discovery and was quite sure he would be able to find the spot again, though it was ten years since he had been there. Unfortunately he was under the impression that there was only one stream-bed, but when we climbed a hill and looked down, we found that the land between us, Eureka Sound, and Trold Fjord, was a low plateau surrounded by high hills. This plateau was drained by hundreds of small gullies. It was on the side of one of these gullies that they had found the monster. To have searched all of them would have taken weeks.

We parted, and while I searched the land in a circle within a few miles of our tent, Nukapinguaq crossed again to Trold Fjord, in the hope that he would be able to follow old landmarks on the way back. The great Nukapinguaq, who usually forgets nothing, was beaten.

We returned to Greenland by crossing the ice-cap south of the Bay Fjord–Flagler Fjord land crossing; the highest point of this ice-cap crossing probably exceeded 4000 feet. We continued *via* the Police Post on Bache Peninsula and Fram Haven without further incident and arrived at Robertson Bay on May 15.

I have been careful to leave out all dates, for the day I started and the day I returned are the two only accurate dates that I know for certain. The dates in my diary, which I had kept at each camp, were five days out. This was perhaps due to the cold from which we suffered very greatly at night. I think often we had only slept for an hour or two when we thought we had slept the whole night through, and owing to my watch stopping from a fall on the ice and the often hazy conditions when the sun was not visible owing to falling ice crystals, the inaccuracy of dates had occurred.

With regard to the tracks of the animals, there was definitely a migration of reindeer, possibly from Banks Island across Amund Ringnes Island and round the south coast of Axel Heiberg Island. Though I realize that what geographical corrections I was able to make are of little value, possibly the descriptions of the country itself may be of some use. I had been under the impression that I would be able to do some rough mapping with the aid of a compass but, as previous parties had found, among these islands the compass is quite useless and did not even roughly point in the direction of the magnetic pole.

Of our travelling equipment there is not much that I would alter if I was making the same journey again. Of the types of sledge, the Nome sledge might have been better for this journey than the Thule type of Greenland sledge made of Victorian ash 1 inch thick and fitted with adjustable broad Nansen runners. This latter was adequate, but I believe a sledge made of the same wood $\frac{3}{4}$ inch thick would be strong enough. I do not believe that

the journey we made would be possible if we had had to take all our food with us; and where a party is hoping to live largely off the country though not relying on doing so, a large team of dogs is useful. We had a team of sixteen and in all sledged nearly 1500 miles without killing a dog. The average weight of the team before starting was 80 lb., and on returning 70 lb. One puppy born on the journey was brought safely back to Greenland. The best number of dogs for this kind of journey I consider to be ten or twelve, but Nukapinguaq would have preferred eighteen or twenty. These big teams and long sledges were not introduced to the Eskimo by Peary, as is popularly believed, for the last migration of Eskimo which came to Greenland from the Canadian Arctic Islands brought with them sledges 20 feet long and teams of eighteen to twenty dogs.

The food we took with us was equal amounts of Bovril dog pemmican and walrus meat, and it is interesting to note that the Eskimo, who say that our tents, sledges, and eiderdown sleeping bags are superior to Peary's, thought our dog pemmican was greatly inferior; in fact the polar Eskimo would rather take half-dried walrus meat than pemmican. It seemed that pemmican was too rich and that the dogs were unable to digest it. A future expedition might make its own pemmican of ground dry walrus meat mixed with different sorts of blubber: seal fat for the cold weather, and walrus blubber for the warm weather. I think far the best results would be obtained by varying the fat content to suit each individual dog and different temperatures.

The summer was spent at Thule where scientific work was continued, as described in the Appendix below.

APPENDIX: SCIENTIFIC OBSERVATIONS

Archaeology

A small collection was found by an Eskimo while cleaning out an old igloo some 15 miles north of Thule. This has been presented by me to the British Museum. A list of the objects, compiled by Mr. Adrian Digby, of the Department of Ethnography, British Museum, is deposited in the Library, R.G.S. Most specimens are of undoubted Thule culture.

Aurora

A camera had been lent by Dr. Leiv Harang, of the Auroral Observatory, Tromsö, for photographing homogeneous auroral arcs to determine their directions, but no arc observed was sufficiently intense to be photographed. Although 1937–38 is near the time of maximum sunspot activity the paucity of aurora at Thule was very striking to one who has spent a winter in Svalbard. But that is near the zone of maximum frequency, while Thule is less than 2° from the pole of the magnetic axis, though nearly 10° from the north magnetic pole.

Visual observations were made when possible at every hour when the weather was fine. On 92 per cent. of the occasions no aurora was visible to the naked eye, and on only 3·5 per cent. was the intensity of the aurora greater than 0 on the international scale, that is brighter than the Milky Way. It is not possible to say whether there is a stronger tendency for aurora to occur at any one time of day as the number observed was so small, and the fluctuations of the totals for each hour were no greater than the probable fluctuations. When aurora was visible it was always to the south. The weather was clear and no aurora was

visible on the evening of 25 January 1938, when there was the great display in England.

Tides

Tide observations were made over one lunar month, 22 August to 20 September 1937, on a graduated stake fixed in the sea-bed. The harbour time was 11 hours; mean range of tide 1·65 metres; and range of spring tide 2·50 metres. Next month the spring tide was higher and the range about 3·4 metres. The detailed tidal observations were given to the Hydrographic Department of the Danish Admiralty.

Weather

Routine meteorological observations were made at Thule from September 1937 to February 1938. Pressure was measured with a Kew Pattern Mercury Barometer together with other instruments lent by the Meteorological Office. Corrected monthly means show little variation between the pressure at standard hours 00, 12, and 17 G.M.T. Temperatures were measured by a sling psychrometer. Wind was estimated on the Beaufort scale. Gales were rare, and winds of force greater than 3 were infrequent. The winter months were very clear with mean cloudiness about three-tenths. The detailed observations have been sent to the Danish Meteorological Institute.

Monthly averages at Thule

	Bar. mb.	*Temp. F.*			*Extremes*		*Cloud: tenths*			*Wind: Beaufort*			
	08^h	08^h	13^h	20^h			08^h	13^h	20^h	Calm	1–3	4–7	8+
1937 Sept.	1007·5	31·4	34·0	31·6	43	18	6·4	5·2	5·7	18	38	14	1
Oct.	1010·7	14·8	16·5	14·2	30	−2	4·9	5·0	4·4	29	37	18	0
Nov.	1008·8	11·4	11·1	10·7	32	−15	6·2	6·1	5·3	33	37	17	2
Dec.	1013·6	− 6·0	− 6·5	− 7·3	19	−27	4·9	4·5	3·1	38	38	14	3
1938 Jan.	1007·6	−18·3	−18·9	−18·9	22	−40	2·9	4·1	3·2	33	44	14	2
Feb.	1011·8	−19·9	−21·8	−20·7	7	−34	2·9	1·9	2·4	25	43	7	0

Times are 5^h slow on Greenwich M.T.

Zoology

The skulls of five polar bears, six arctic foxes, two white wolves, six ringed seals, one harp seal, one bearded seal, and two arctic hares, and the skins of two arctic wolves have been presented to the Natural History Museum. A note on the two skins by Mr. Pocock is deposited in the Library, R.G.S.

Birds

A small collection of birds has been presented to the Natural History Museum. It includes specimens of the greater snow goose found nesting at Thule, with its down and eggs; a specimen of Sabine's gull, and of an American rough-legged buzzard. Full details of the nesting of the greater snow goose will be published in the *Ibis* and deposited at the Scott Polar Research Institute. The birds' nesting seems to depend upon the amount of snow. Many nested at Thule in 1935. That summer at McCormick Bay there were no more than eight, but in June 1938 Wright counted fifty; and there were twenty-five at Thule, where two nests were found. The Eskimo say that there was more snow at Thule in 1938 than in 1935. Two of the geese brought home from Thule reared five goslings in captivity in England in the summer of 1939.

Geology

Some geological specimens from Amund Ringnes Island have been sent to Professor Holtedahl for comparison with specimens from Sverdrup's Expedition. He reports that a piece of fossil wood resembles a specimen from Schei's Tertiary collection made on the latter expedition.

Botany

A large collection of dried flowers was made and presented to the Natural History Museum.

DISCUSSION

Before the paper the CHAIRMAN (Professor KENNETH MASON) said: The paper to be read this evening is on "The British Expedition to Ellesmere Island, 1937–38," by Mr. David Haig-Thomas. Mr. Haig-Thomas has already been before the Society as a member of the Oxford University Expedition to Ellesmere Island in 1935. He has since returned there, and I ask him now to tell us about his expedition.

Mr. Haig-Thomas then read the paper printed above, and a discussion followed.

Mr. JOHN WRIGHT: I am glad to be the first to be able to congratulate Mr. Haig-Thomas on the clear and amusing account he has given of our expedition and to thank him for the extremely nice remarks he has made about me. I am glad also to have the opportunity of thanking him for taking me on the expedition and for the free hand he gave Hamilton and me in working out our plans for the journey we made.

I would like to add to the thanks which he has given to all those who helped the expedition, particularly to those who made our stay in Greenland such a pleasant one, including the members of the Danish administration in Thule. After all, we were uninvited guests, and yet they treated us the whole time with the most open hospitality. I also have particular reason to be grateful to Commander MacGregor and the other members of the American Expedition for their kindness, as I spent nearly two months with them and made a short journey on the ice-cap with a member of their expedition.

Haig-Thomas has said a certain amount about the journey Hamilton and I made, so that I do not want to describe it in detail; it was extraordinarily dull. We went very slowly and made a map and almost nothing happened.

There are however one or two comments I should like to make about the map, and I fear I shall have to be a little technical. In recent years there has been used in the Himalaya an instrument described as a "photo-theodolite," but which only consisted of an ordinary camera fixed to an ordinary theodolite. By the kindness of this Society, and particularly of Mr. Hinks, we were able to have a camera attachment of that kind made for our theodolite before we left England. The results are astonishing. There were marks on the top and bottom and sides of our photographs which gave all the necessary data. From those photographs we can take, in the comfort and warmth of a room at home, all the angles which we ought to have taken in the field. The effect of adding the camera to the theodolite has been to turn what would have been an accurate but only a skeleton map of the coast into what I hope will be quite a detailed contour map of a large part of the hinterland as well. I cannot too strongly recommend this easy-to-make, easy-to-use, and cheap attachment to the notice of future Polar and other explorers.

A large proportion, in fact considerably more than the fair share of his work on this journey, was done by Hamilton. As those who know him would have expected, he undertook all the unpleasant, dull, and difficult work not only in the field but after we returned, when it was not his job at all. While I was away with the Americans having a good time, he sat down every day and worked out the astronomical results. All I had to do when I returned was to start actually drawing the map, which is of course the most interesting part.

Finally, I would like to say something about travelling with or without

Eskimo, because I think that is important. It seems to me that Hamilton and I are in a position to speak with a certain amount of authority, as we have both been on two expeditions, one when no Eskimo were available, and the other when they were.

Practically all previous expeditions to the Smith Sound region have had Eskimo with them; in fact, a large number had more Eskimo members than white. Edward Shackleton, the organizer of the last big British expedition to the area, told this Society that Eskimo were one of the secrets of Polar travel (*Geogr. J.* 87 (1936) 438). This is a very different opinion from that formed by recent British expeditions to the east coast of Greenland. One reason for this is probably the better travelling qualities of the Eskimo of Thule district as compared with those of the east coast. For various reasons, partly our own, partly circumstances over which we had no control, Hamilton and I had no Eskimo with us for more than a fraction of the time we were on our journey. I say "had with us" because up in Smith Sound you have to be exceptional white men to take Eskimo with you: you do not take them; they take you. That, I think, is the difficulty, because if you are taken by people, it is difficult not to use their methods of travel, and in modern exploration Eskimo methods of travel usually have very large disadvantages. They depend chiefly on hunting for food, which means that you cannot go where there is nothing to hunt, or at least that you must travel fast through regions where there is no game. Several days must be spent, although the survey may not demand it, in the regions where game is found, in order to rest the dogs and to hunt. A large amount of time is wasted in hunting which should have been used in observations. More important still, many regions are traversed so quickly that they do not get mapped at all. There is no doubt that with Eskimo, as Haig-Thomas has told you, it is possible to travel much faster than without, but for the work Hamilton and I were doing we did not think speed important. We spent a large amount of time in other things besides travel: about four hours a day in taking observations alone, and nearly as much time in climbing up the hills to get good view points. Travelling only a few miles a day it did not matter very much if we only achieved a speed of 2 or 3 miles an hour.

All previous maps of south-east Ellesmere Island had been made from the sea-ice or from ships. If we had relied on hunting we could have done almost nothing on that coast because, as Haig-Thomas has said, it was a desert. There were no animals and we should have had to rely on bears and seals, which were anything up to 20 miles from the coast, out at the edge of the fast ice. So we should either have had to waste a large amount of time travelling to and fro, or have had to stay the whole time several miles from the coast, and we should not have made much of a map from there.

There is probably little doubt that conditions in 1938 were easier than usual as far as pack-ice was concerned, but we managed to overcome all the other difficulties. I mention that, because although it has been done before in the Antarctic and Arctic by British and other explorers without Eskimo, there is a certain tradition in Thule, and I believe also among the Canadian Mounted Police who work on the Ellesmere Island side, that travelling conditions on Smith Sound are harder and more dangerous than elsewhere. I have had only a little experience: one year in North-East Land with Glen and one year in Smith Sound: but from this experience and what I have read and heard I doubt if that is true. With the dogs we had from Jacobshavn, which were poor, we should not however have got far through bad pack-ice without help, Eskimo or white.

I think personally the solution for the modern type of accurate mapping is probably to have two parties. The main party of white men must be competent

enough, and have enough provisions, to be more or less self-sufficient. Attached to them would be an Eskimo party who could visit them, if necessary, once a week to bring them fresh meat for their dogs, and to help them if they happened to meet a lot of bad pack-ice. The rest of the time, that is six days out of the week, the Eskimo could spend in the regions where game was to be found. I very much doubt if an expedition relying solely on Eskimo methods would be able to make a map with the thoroughness and accuracy which modern conditions demand.

I lay stress on the mapping because I am a surveyor. There are plenty of other questions connected with biology, geology, etc., to be dealt with in the Arctic, but before we can get very far with the solution of them we must first have accurate knowledge of the disposition of the land and sea and ice-caps in the Polar regions.

Col. F. M. STANTON (representing the High Commissioner for Canada): I am very glad indeed to have the privilege of thanking both Mr. Haig-Thomas and Mr. Wright for the lecture and for the exceptionally fine pictures which they have shown us. I had the pleasure, as no doubt many of you had, of reading Mr. Haig-Thomas' articles in *The Times* in November 1938. It struck me then how modest Mr. Haig-Thomas was in reciting his experiences. His feat and that of his companions is an exceptionally fine one, from the sporting side alone, but when you realize the amount of scientific work done, I am sure that you will agree that we owe Mr. Haig-Thomas and his party a great debt of gratitude. May I say in the name of the High Commissioner that the Canadian Government appreciates very much the work done by this party?

The CHAIRMAN: We shall be glad to hear a word or two from Mr. Richard Hamilton, who was with the expedition as meteorologist.

Mr. R. C. HAMILTON: I have not very much to add to what the other speakers have said. My own work was research on the Ozone Layer with a Dobson spectrograph. Unfortunately I joined the expedition only a month before it left, and did not have time to make an adequate calibration of the camera before leaving England. As a result no reliable results were obtained. However while Haig-Thomas and Wright were away in the autumn of 1937, I carried out a series of tidal observations during one lunar month, and started a programme of weather observations which continued until we all left Thule at the end of February 1938.

I want to thank David Haig-Thomas very much for taking me, and John Wright for being the best companion I ever had. I also add my thanks to the Danish authorities, particularly Kolonibestyrer Hans Nielsen, of Thule, to whom I owe a great deal, and also to Dr. Scheibel. He and Frk. Bentzen were kind enough to take ozone photographs for me while Wright and I were away in Ellesmere Island.

Mr. ANDREW CROFT: I should like to congratulate Mr. Haig-Thomas on his expedition. His film is magnificent, and I believe he is the first member of any British expedition to take a full-size 35-mm. camera on a long sledge journey. I was particularly fascinated by the musk-oxen. While the pictures of them were being shown this evening, I overheard expressions of surprise that these animals manage to procure sufficient food during the winter. Musk-oxen as well as caribou generally inhabit areas where mosses and lichens are plentiful, and these they dig out with their forefeet from underneath the snow. Occasionally however the ground becomes covered with ice in the late autumn owing to a combination of thaw and frost; the animals then have difficulty in procuring food, particularly when it becomes buried under tightly packed snow, and a large proportion of the herds may die of starvation. Fortunately such

conditions are unusual and, with the protection afforded by the Canadian Government, both musk-oxen and caribou appear to be on the increase.

We have not heard very much about the survey of the east coast of Ellesmere Island, between Bache Peninsula and Makinson Inlet, which was accomplished so successfully by Mr. Wright and Mr. Hamilton. The coast which they were surveying is almost inaccessible by ship, as a field of ice several miles wide usually presses up against the shore. A number of attempts have been made to survey it, but none has greatly improved on the map of Captain Edward Inglefield, who discovered the coast in 1852. Wright and Hamilton have at last succeeded, and they are to be congratulated on a valuable piece of work.

Although I was home agent of the expedition, a great deal of the work was undertaken by Mrs. Haig-Thomas, including all the financial responsibilities. One or two crises occurred, concerning possible changes in the expedition's programme, and also the question of taking Greenland Eskimo into Canadian territory. On these occasions the Council of this Society gave valuable help, and most of the work entailed rested on the broad shoulders of Mr. Hinks.

Mr. J. M. WORDIE: My contact with Mr. Haig-Thomas was a very short one, as my ship was leaving north-west Greenland just as his expedition was going in. This was in the autumn of 1937, and we naturally envied him, as we felt sure that he would bring back good results—Wright's map, for instance, and his own sledge journey away to the west, when the new island was found. I must specially mention the cinematograph film, which is quite the best Arctic film seen in this Hall, and particularly the shots of sledging and of musk-oxen. We should all, I think, have liked to have seen still more of these simple and engaging animals.

You have also listened to Mr. Wright on whether Eskimo are an advantage or not on modern sledge journeys: a matter of keen controversy in the last ten years. He spoke with confidence, and I for one was convinced. For the first time some one has spoken who could do so without prejudice, for Wright previously had been in North-East Land with Glen, where they had no Eskimo helpers and believed that they need never be necessary. In spite of this Mr. Wright has now made a case for having Eskimo, though in a limited sense, and has probably said the last word on this very important problem.

May I also say a little about the map of Ellesmere Island? I have always been particularly attracted to this coast because of Inglefield's great voyage in 1852. I thought we might have mapped it in 1937, but our ship was pitched away from the coast by pack-ice. Haig-Thomas realized it was best done by sledging, and Wright and Hamilton have had the good fortune to make the first detailed map of the coast and of the adjoining mountains. Admiral Inglefield is here to-night, and I should like to tell him of the very great pleasure it has given his friends to see the coast-line which his father discovered mapped at last after an interval of nearly ninety years.

Admiral INGLEFIELD: It is a very unexpected honour for me to be called upon to speak to-night, and I appreciate the privilege of being able to thank Mr. Wordie and Mr. Croft for so kindly mentioning the early discoveries made by my father in his little yacht *Isabel* in 1852. Naturally it has always been to me a great inspiration and pleasure to read his book and to look back on the very fortunate discoveries that he was able to make. I feel that I owe, on his behalf, very grateful acknowledgments to the two speakers who have mentioned his eventful voyage.

The CHAIRMAN: You will not expect me, having no experience in the Arctic, to do more than ask you to accord a very hearty vote of thanks to Mr. Haig-Thomas for his extremely interesting discourse, his beautiful slides, and his excellent film.

SOUTH-EAST ELLESMERE ISLAND

JOHN WRIGHT

A SURVEY in south-east Ellesmere Island was made by Richard Hamilton and myself during the spring of 1938. We were members of a small expedition led by David Haig-Thomas, who describes the other activities of the expedition in this *Journal*. Unfortunately, Hamilton had to take up work in Iran early in 1939, and I had not his help in writing this account of our joint effort.

I should like to thank David Haig-Thomas for taking me on his expedition, and for the free hand which he gave Hamilton and myself in preparing for our journey. To Kolonibestyrer Hans Nielsen, and the other members of the Greenland Administration, particularly those in Thule, I can never adequately express my gratitude for their kindness during our stay in Greenland. My thanks are also due to Trinity College, Cambridge, for generous financial support which enabled me to take part in the expedition and to prepare the map on my return. In preparing this paper I received help from many sources; I am most grateful to Mr. Brian Roberts for his assistance throughout by severe but constructive criticism.

Previous exploration

The southern part of Ellesmere Island was first seen in 1616 by Bylot and Baffin on their famous voyage to lat. 77° N. They could not approach nearer to the coast than 50 miles, and had only a very rough idea of its trend. We know what their map was like only from atlases of that date. Just over two centuries passed before another European visited these regions. In 1818 Sir John Ross reached lat. 76° 54′ N. He was never near the western side of Smith Sound, and was convinced that no sound leading northwards existed.

A most important contribution to the exploration of this coast was made by Commander E. A. Inglefield in 1852. In his 150-ton steam yacht, the *Isabel*, Inglefield reached the narrowest part of Smith Sound in lat. 78° 30′, and made a careful survey of both shores. Like his predecessors he could not get near the western side, and this part of his map was much less accurate than on the Greenland side. The large Cadogan and Baird Inlets are shown on his chart as glaciers. The whole of this western shore, and also part of Greenland, were charted about 30 miles too far to the west, which was a very large error of longitude even for those days, but the general trend was better shown than in almost any subsequent survey down to 1938.

Inglefield gave names to the principal features of the coast, most of which are easy to identify. But nearly all subsequent explorers of this coast failed to place them correctly, so that many of these original names have been given to the wrong features ever since. I have tried to clear up the confusion, and to place the names in the most suitable positions, though these are unfortunately seldom the original ones.

Almost immediately after Inglefield's voyage came the series of expeditions led by Kane (1853–55), Hayes (1860–61), and Hall (1871–73). The last two produced new maps of this coast which were more accurate in the north than Inglefield's survey, though less so in the south. But they made mistakes in

applying Inglefield's names. The story of Hall's expedition is well known: his own death from natural causes, and the loss of the ship, followed by the

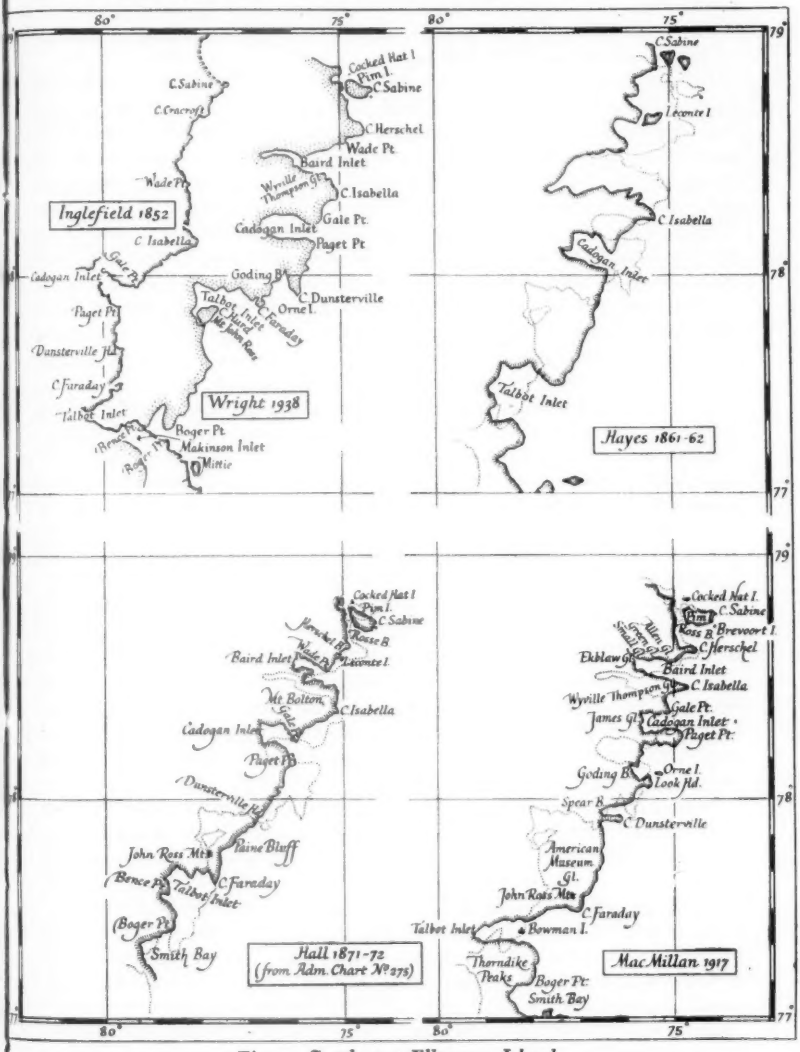


Fig. 1. South-east Ellesmere Island

almost incredible drift of half the party on an ice-floe from Smith Sound nearly to Labrador. Most of the records of surveys were lost, but in 1874 a

chart was published by the U.S. Hydrographic Office which embodied the discoveries of this expedition, and of Kane and Hayes, with a detailed survey of the south-east coast of Ellesmere Island from observations on the northward voyage of the *Polaris* in 1871. This chart formed the basis for nearly all subsequent maps of this area.

In 1875 and 1876 parties from the British Arctic Expedition led by Sir George Nares landed at Cape Isabella, and a survey of the mouth of Baird Inlet was made by Captain Stephenson and Lieut. Archer. Nares also drew a careful panorama of the stretch of coast visible from Littleton Island on the other side of Smith Sound. He appears to have corrected Stephenson's and Archer's survey from this, and the map of Baird Inlet was redrawn several times before it was finally established in 1878. Since that date there has been no change in the Admiralty charts of south-east Ellesmere Island, based on the surveys of Hall and Nares.

The only recorded visit of a ship to any part of this coast south of Cape Isabella was made by H. G. Bryant while leading Peary's auxiliary expedition of 1894. He landed at what I have called Cape Dunsterville, built a cairn on the summit, and left a record which we found in 1938.

All the surveys mentioned so far were from ships or from sledge parties a long way from the coast. In 1917, the last year of his Crocker Land expedition, D. B. MacMillan made a survey much more detailed than anything done before. After an attempt in early April which was defeated by bad ice conditions, he succeeded in late April and May in travelling down the whole length of the coast from Cape Sabine to Clarence Head. His survey was never published in full, though a very rough sketch-map was given in the end papers of the second edition of his book 'Four years in the White North' (The Medici Society, London and Boston, 1925). By the kindness of the American Geographical Society I have obtained a copy of the original unpublished map, which shows in considerable detail most of the main features. Commander MacMillan also was kind enough to send me a list of the origins of the names which he had given to various features. It was impossible under the conditions of his journey to make many astronomical observations, and the positions of several features are considerably in error, although more or less correct in relation to each other.

In the spring of 1928 Constable G. T. Makinson travelled along the coast from Bache Peninsula to Craig Harbour and back, and on the return journey made a rough map of the inlet which is called after him. He also, on the outward journey, observed the small island which MacMillan had already discovered and named Orne Island. But in compiling the North-West Territories Map of 1929, the Canadian Survey had not MacMillan's survey, and the differences between this map and the British Admiralty charts of this region are evidently due solely to information obtained from R.C.M.P. patrols.

To the north was the survey made in 1901 by the late Major Isachsen, of the second *Fram* expedition led by Captain Otto Sverdrup, round their winter quarters at Fram Haven, controlled by frequent astronomical observations and triangulations. We joined up with it at Cape Herschel and at the head of Jökel Fjord. There were discrepancies of about a mile, more than we

thought could be ascribed to errors in our survey; and Mr. Wordie in 1937 found small errors in the map of Bache Peninsula, which was part of the same survey.[1] I wrote to Major Isachsen and he considered it quite possible that there would be errors of this order in his survey.

Our map (following p. 328) was designed to fill the gap left between Isachsen's survey in the north, and work being done by Robert Bentham in the south. He spent the two years 1936–38 at Craig Harbour, and we heard from Thule Eskimo who had visited him in the spring of 1937 that he was then surveying Makinson Inlet and planned to extend the work westwards in the following year; he made a plane-table traverse controlled by a few astronomical observations. He was with a fast-moving R.C.M.P. patrol, and was doing geological work at the same time. The coast and mountains south of Makinson Inlet on our map were plotted by combining photographs and angles taken from our station 729 metres above Boger Point with a round of photographs taken *en route* by Bentham, which he kindly placed at my disposal. His position on the sea-ice I determined by resection with the photographs from points on the coast, which we had already fixed by depression angles from Boger Point. The mountains were then mapped by combining the two sets of photographs, his taken with an uncalibrated camera.

Narrative of the 1938 expedition

We had to lay depots because of the large distance to be travelled from Thule. To reach our field of work, only about 150 miles away, it was necessary to travel 200 miles up the Greenland coast before we reached a place where Smith Sound could be safely crossed, and then to come down the other side another 50 miles before the centre of the unsurveyed coast was reached. Including relays, we had covered about 500 miles by sledge before we began to survey at all.

The greater part of this depot laying had been accomplished in the autumn of 1937 when Haig-Thomas and I, aided by two Eskimo, had made depots of food and fuel at Etah, and on the coast about 10 miles north of it. In 1938 therefore we had to take from Thule scarcely anything but our equipment and food for a few days, since it was possible to obtain dog food at the settlements on the way to Etah. Once there, we had only to take all our provisions across Smith Sound, and leave depots on the other side as we sledged down the coast. In this way we could get rid of our large loads as early as possible, and then cut down the number of dogs to the minimum necessary to carry us from one depot to the next.

We started from Thule on 26 February 1938, with a light sledge pulled by our two teams combined. After a delay at Robertson Bay due to bad weather and the difficulty of getting an Eskimo guide, we reached Etah on March 12. As long as we were in Greenland and occupied only with travel, we used Eskimo as guides and to help with our loads, but for reasons which I have outlined in the discussion following Haig-Thomas' paper (see pp. 274–6), we did not have any with us in Ellesmere Island except for two short periods.

At Etah we found an American expedition under the leadership of Mr. C. J.

[1] Wordie, J. M., "An expedition to North-West Greenland and the Canadian Arctic in 1937," *Geogr. J.* 92 (1938) 398.

MacGregor of the United States Weather Bureau. His party had been forced to winter here by an accident to their ship. They were living in the hut built in 1934 by the Oxford expedition led by Dr. Noel Humphreys, and had made an extension to it. Their generosity and hospitality to us were unbounded, and they offered us many items of their equipment and food, some of which we were very glad to accept.

Hamilton and I started from Etah on March 18 in company with Haig-Thomas and his Eskimo companion, Nukapinguaq, but parted from them three days later in the middle of Smith Sound. Their help and particularly the Eskimo's expert knowledge made a great difference in the rather difficult stretch of sledging up the Greenland coast, where we had to follow ice-foot or land routes practically the whole way.

In this part of Smith Sound in the early spring the ice to the north is usually in a solid pack whose southern edge forms a curve from about lat. 78° 40′ N. on the Greenland side to Cape Sabine (lat. 78° 30′ N.) on the other. The curve is convex towards the north, and reaches approximately to lat. 79° N. South of this is a stretch of almost open water from side to side, and probably about 20 miles from north to south. Along the southern edge of the pack there forms in calm periods a fringe of new ice sometimes as much as half a mile broad. The ease or difficulty of crossing from Greenland to Canada depends almost entirely on the state of this fringe. The pack-ice to the north usually makes very heavy sledging, and if the new ice has recently been removed by a gale or by spring tides, a party may take several days to cross. On the other hand, after a long calm period there will be a flat fast highway of new ice which can be crossed in a single day.

In 1938 we found this fringe complete nearly the whole way across, and later made the crossing with empty sledges in under two days. Haig-Thomas and Nukapinguaq parted from us in the middle of Smith Sound, since their route lay westwards to Bache Peninsula, while we followed the edge of the ice south-westwards to Cape Sabine, and from there along the north side of Pim Island to Fram Haven. The last part was rough and took us three days to cover with our loaded sledges. We had regarded the hut at Fram Haven as a possible advanced base, but it proved disappointing. It was only a single-walled shelter, and we could find no coal for the stove. Since we had, in any case, to return to our depot on the Greenland coast for a second load, we decided to cover the extra few miles to Etah, where we could rest the dogs for a day and dry our clothes in the warm hut. Temperatures had been in the minus thirties, and we had not been very careful about our clothing.

The second crossing of Smith Sound with laden sledges was very much easier than the first, because the way was already found, and we had simply to follow our previous tracks. April 3 therefore saw us starting southwards from Fram Haven with two sledges each pulled by seven dogs and each carrying about 500 lb.

With one exception our dogs were from farther south in West Greenland, and they undoubtedly were inferior to those of the Thule district. Fortunately we had very little trouble with pack-ice, and did not require to travel either fast or far, and these dogs were quite adequate for our purpose. Usually they were fed on a pound of pemmican each per day, but early in May we

met an Eskimo bear-hunting party and obtained meat from them in exchange for paraffin, tea, sugar, and other things. We shot four of our dogs at the beginning of April, when our depots were being made. Another had to be shot because he bit through his trace continually and we had no chain with us, and a sixth fell down a crevasse. We thus finished with eight out of our original fourteen dogs. This cutting down of numbers was necessary, since we intended to waste no time in hunting, and had neither food nor use for a large number of dogs once our depot laying was finished.

One of the two sledges with which we started was a 12-foot Eskimo *komatik* similar to that used by most expeditions working in this region. The other was a Nome type sledge, sometimes known as the Alaskan or basket sledge. It was of the usual design, with the important exception that it had no proper bow. We eventually made a satisfactory one from the iron runners of the *komatik* when this was discarded. The Nome sledge had broad runners shod with steel, which ran well in deep snow and on new sea-ice, and it was for this reason that we retained it in preference to the narrow-runnered *komatik*. The Nansen sledge which we had taken from Thule was much too fragile for sea-ice work, and we were very glad of the Alaskan sledge, which MacGregor lent us in its stead.

Both Hamilton and I had been members of A. R. Glen's expedition to North-East Land in 1935–36, and our tent, sleeping bags, and cooking gear were either modelled on or identical with those we had used during that expedition. Glen describes them fully in 'Under the Pole Star' (London, 1938). The only difference was in our tent, which was single, and made of material which was too waterproof, so that an unduly large amount of frost collected inside.

Our ration was variable, both because we obtained some bear meat for a few days while travelling with an Eskimo party, and also because we sometimes underestimated the time that we should be away from our depots, and had to cut down rations for a day or two. On the whole however the ration per man per day was: fresh meat, about 2 oz.; Bovril pemmican, 7 oz.; Blue Band margarine, 4 oz.; Quick Quaker Oats, 4 oz.; Cadbury's plain chocolate, $3\frac{1}{2}$ oz.; sugar, 3 oz.; McVitie and Price Cabin biscuits, 2 oz. (total: $25\frac{1}{2}$ oz.). We also took small quantities of vitamins, but scarcely used them because of the fresh meat we obtained. This ration was quite sufficient in the temperatures we experienced, which rose steadily after the beginning of April from −20° F. until they reached freezing-point. We used about a gallon of paraffin a week at the beginning of the journey when temperatures were low and the sun was not giving sufficient heat for drying our sealskin boots. Later we reduced to less than a gallon a fortnight, because we had traded a considerable quantity to the Eskimo party.

Our clothes were similar to those worn by the Eskimo, except that I discarded my bear-skin trousers in the middle of April in favour of flannel trousers and windproofs. We always wore flannel trousers in our sleeping bags, and the business of changing from them into bear-skins was cold and uncomfortable. The clothing of the Polar Eskimo has been fully described by other writers, but a few comments may be of interest. The upper garment or *qulitsaq* (usually spelt as it is pronounced—*kuletah*—in expedition books) is of

reindeer skin and is not usually necessary after the end of April for ordinary travelling, but we kept ours all the time because they were so wonderfully warm for surveying. They were very much better for this kind of work than any woollen and windproof clothing that I have used; but I have never used Wordie cloth, only Grenfell and Burberry windproofs over a blanket-cloth coat, and woollen sweaters. While handling instruments we wore thin gloves of cat skin with a separate forefinger. These were suggested to me by Professor Debenham from his experience during the *Terra Nova* expedition.

With this equipment we started southwards from Fram Haven, and travelled for five days, most of which were stormy. Depots of a few days' food each were left near Cape Isabella and Paget Point. It was clear then from the state of the ice that the open water might easily reach to these points before we returned, as in fact it did, and the depots were therefore left on sheltered parts of the coast which could also be reached from the interior.

The survey began at Cape Dunsterville on April 10. We had been warned by the Eskimo to expect deep snow farther south and in the interior, but so far we had travelled over a completely hard windswept surface. It seems that storms corresponding to those experienced on the Greenland side at the same latitudes frequently sweep down from the Ellesmere Island ice-cap. From both sides these winds blow towards Smith Sound and southwards, and are responsible for, and perhaps also caused by the permanent open water. Apart from three of these storms and occasional days of cloud and gentle snowfall the weather was almost uniformly sunny and calm.

From Cape Faraday we continued into Talbot Inlet, where we met the first deep snow. We had only one pair of skis, but managed to make a rough pair of snow shoes out of the sides of a ration box, the turn up being made of tin from a dog-pemmican case strengthened with a wooden rib. They were not very comfortable, but were quite invaluable in the conditions we experienced here and in the interior: a weak crust covering about 2 feet of soft snow.

From the head of Talbot Inlet a short journey was made over the ice-cap, and two stations were occupied to map the mountains behind this inlet. The ice-cap here appeared to be very thin, and it was extremely uneven and crevassed. The windlessness of this region evidently made it impossible for bridges to form over crevasses more than a metre broad, so that this area provided much safer travelling than appeared at first sight.

The south side of Talbot Inlet is formed by what we have called Easter Island. It is only a few square kilometres in area, but nevertheless has a large number of glaciers and most of its coast-line is ice-cliff. The glaciers are short, but they expand so much at their fronts that they almost coalesce into a piedmont.[1] No signs of land were visible beneath their fronts, but a tide-crack shows that they are not floating tongues. It is probable that they end in shallow water, and that a very slight retreat would expose bare rock above sea-level. In the south-west corner of the inlet the glaciers from the mainland and from the island nearly meet, and the gap is blocked by low flat bergs, probably calved from the big Talbot Glacier. The end of this is very much crevassed, and may quite possibly be afloat.

[1] I have used the classification given by G. W. Tyrrell in his paper on the "Glaciers of Spitsbergen," published in the *Transactions* of the Geological Society of Glasgow, XVII, part I, 1919–22.

From Talbot Inlet down to Boger Point the coast is an almost continuous ice-cliff, broken only by Eskimo Bluff. Behind this cliff is a foreland covered by ice, which is free of any nunataks between its front and the outer edge of the Inglefield Mountains, about 15 kilometres inland. This ice-sheet appears at first sight to be a piedmont fed by glaciers breaking through these mountains, but there is actually a definite dome over 300 metres high between the mountains and the sea. The contribution of the glaciers must therefore be small, since this dome is presumably the main source of supply. The glacier probably covers a stretch of low-lying land which reaches sea-level near the present edge of the ice. We did not see any bare rock beneath the ice-cliff, but we were nearly always some distance away, and the foot of the ice-cliff was usually hidden by snow. The glacier front does not seem to be afloat, since most of the icebergs off-shore were certainly aground, but we did not have an opportunity to see whether a tide-crack existed near the glacier itself.

This glacier appears to be almost Antarctic in character, and is especially like those covering the forelands of Adelaide and Antwerp Islands in Graham Land. They have been described by Professor Holtedahl,[1] and the Rev. W. L. S. Fleming and Mr. Brian Roberts, of the British Graham Land Expedition, 1934–37, drew my attention to the resemblance. This type of glacier does not seem to have been recorded from the Arctic before, but there are not many areas in the north where such heavily glaciated land can be seen. Only in north-east Spitsbergen and Franz Josef Land are small ice-caps also so greatly developed that they extend to the sea. It is very probable that other parts of the Arctic presented similar features during a more severe stage of glaciation, and the areas mentioned are the more interesting for this reason.

Holtedahl considers that the strand flat found in Spitsbergen and northern Scandinavia may have been formed by glaciers like the one described above. Other authorities consider that the strand flat was more probably formed by fringing glaciers similar to those which now occur in Graham Land. No examples of such glaciers were seen in Ellesmere Island, nor, so far as I know, have they been recorded anywhere else in the Arctic. But superficially at least what MacMillan has called the American Museum glacier and the northern part of Easter Island do resemble the ice-covered forelands described by Holtedahl, and we may have in them a connecting link between this type of glacier, hitherto found only in the Antarctic, and the strand flat only in the Arctic.

Opposite this glacier, in the latitude of Eskimo Bluff, we met the party of Eskimo bear hunters after whom we named this feature, and we travelled in their company as far as Boger Point and back, meeting them again by arrangement at Orne Island. One of these Eskimo had just been nearly as far south as Clarence Head, where he had seen the tracks of Bentham's party heading into Makinson Inlet. This confirmed what we had heard of Bentham's plans, and beyond leaving messages in cairns on prominent points, we made no attempt to get in touch with him. I later learned that he was in this vicinity about three weeks before us, so that it was fortunate that we did not waste time trying to find him.

[1] Holtedahl, Olaf, 'On the geology and physiography of some Antarctic and Sub-antarctic Islands.' Scientific Results of the Norwegian Antarctic Expeditions, 1927–28 and 1928–29, instituted and financed by Lars Christensen. No. 3, 1929, pp. 14–17.

From the top of Boger Point we had a very fine view to the south and east, and took photographs and rounds of angles which later provided a satisfactory connection with Bentham's map. On the way north again we accompanied the Eskimo for a few miles and saw them conduct a successful bear hunt. To do this they had to travel about 10 miles from the coast, thus confirming our view that hunting and serious survey were incompatible. The bear which they killed was the only one we saw, though there were many tracks north and west of this point, and in Baird Inlet.

We occupied a series of iceberg stations east of Easter Island on our way north, and reached Orne Island again on May 1. Here we met the Eskimo again, and one of them showed us old igloos which had been inhabited about twenty years ago by some Eskimo who now lived in the Thule district. The igloos were very much older than this, and the roof frames were cunningly constructed from the bones (chiefly scapulae) of a large whale. Apart from these we saw absolutely no signs of previous Eskimo occupation, as was to be expected, considering the barren nature of the land.

The coast survey was now complete as far north as Cape Dunsterville, where we had started mapping on the southward journey. We had nearly a month in which to finish the coast to the north, and if possible to find out something about the interior as well. We had a little of our food with us, but most of it was in the depots which we had left on the way out, and it was a relief to find that these had not been disturbed by bears. This was very different from Haig-Thomas' experience, but we were not in the country where bears were common, and our depots could not be easily smelt, since they were formed of food packed in tins.

The ice conditions along this northern stretch of the coast had changed considerably since our former visit, and we had to travel over the Lyman glacier and behind Cape Isabella because there was no ice left outside them. The traditional Eskimo route on these occasions lies over the Sparks glacier between Goding Bay and Cadogan Inlet, but we wished to follow the coast as closely as possible. When we reached Wade Point on May 13 the coast survey was finished, and as we still had ten days' food with us, a reasonably long journey into the interior was possible. We had of course been able to fix the positions of a number of inland peaks, and the directions of the glaciers which came down to the sea, but had otherwise no idea of the inland topography.

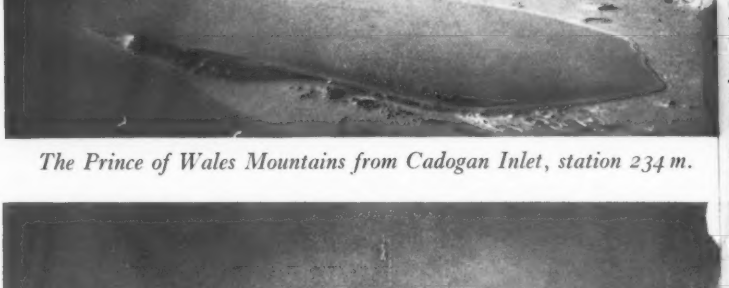
A small depot of food, spare equipment, and copies of observations was left at Wade Point, and we found an easy way up the Alfred Newton glacier. For three days we sledged westwards over the ice-cap about 4 miles from the north side of Baird Inlet. Each night we camped on a dome or southward-jutting spur, and took angles and photographs from it before we left in the morning. The weather was superb; we had practically continuous sunshine from May 10 until the end of the month.

The country here is a series of huge steps about 2 miles broad running east and west for 20 or 30 miles. The treads are ice-covered, while the north or south-facing risers are cliffs several hundred metres high, over which occasional small glaciers flow. The basins of these small glaciers were usually crevassed, and a considerable northern circuit was sometimes necessary. Unlike the crevasses farther south, these in the north were often quite difficult

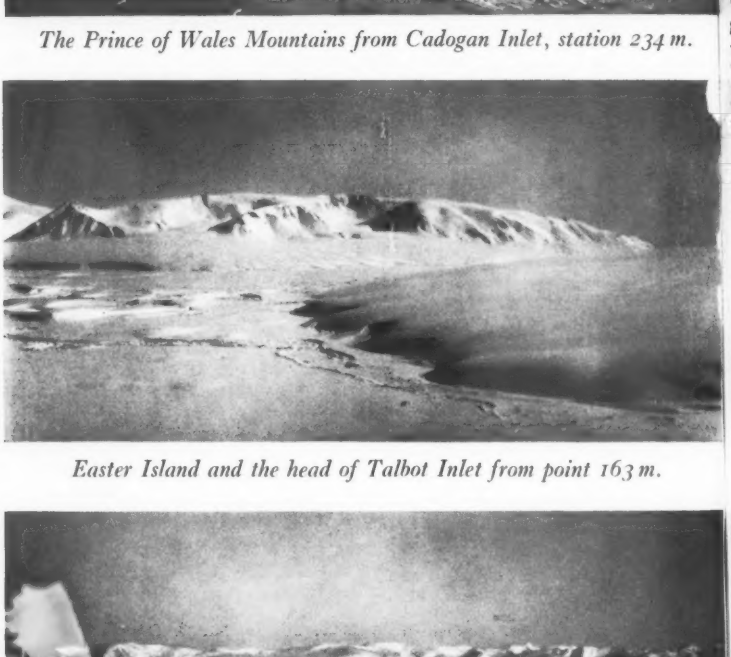
View west from Boger Point: entrance to Makinson Inlet in the background on the left

View across Wykeham glacier from near station 750 m.

The Prince of Wales Mountains from Cadogan Inlet, station 234 m.



Easter Island and the head of Talbot Inlet from point 163 m.



View south-west from ice-cap station 860 m., above MacMillan glacier

to see, although some of them were large enough to be dangerous. This was because there had apparently been enough wind during the winter to build bridges across them. We lost one of our bitches down such a crevasse, because her trace broke while we were trying to pull her up. This was almost our only adventure.

From our third camp (C) on the ice-cap we turned slightly northwards to view in that direction, and from points near the fourth and fifth camps and E) we were able to see and map the head of Jökel Fjord. This gave us a connection with the survey made by Isachsen and Braskerud in 1899. We also occupied a southward spur of the 1850-metre ice-capped summit, just to the east of camp E. This camp lay at the head of one of the north-to-south glaciers which was rather longer than most. It broke through two of the steps, and dropped down to the Ekblaw glacier with a comparatively gentle gradient. Facing it almost immediately opposite rose a similar glacier, which had its head in a col right among the higher summits of the Prince of Wales Mountains. Five hours' sledging took us down one and up the other to camp F, where we were within easy reach of the 1810-metre summit, from which a wonderful view over the mountain range was obtained. We were now, so to speak, on confidential terms with peaks which we had hitherto regarded with distant respect. Here unfortunately our films were finished, and subsequently we had to depend on sketches and detail-fixes with the theodolite.

After our return to the camp we spent a short time investigating a small crevasse near it. It was of a comfortable width for climbing in, and I was able to descend easily to a depth of about 4 metres, while Hamilton held me on a line. Further progress was stopped by a thick bridge of ice, but I could see through a few holes in this that the crevasse continued at least as far down again as I had already descended. The temperature in the crevasse was 6° F., only 3° lower than the air temperature outside. Its walls were of firn crossed by a few bands of ice, some of them several centimetres thick. So far as I could see these showed no sign of becoming thicker or closer together in the lower layers of the ice-cap. The height of this camp was about 1400 metres.

We retraced our steps down to the huge Ekblaw glacier and followed this to the sea at the head of Baird Inlet. The glacier itself forms a magnificent highway, but it is very difficult to get on or off where it meets the sea. Only after several hours' search did Hamilton eventually find a way down between the glacier and the mountain-side to the south. Even then it involved lowering our gear over a 30-foot cliff at the edge of the glacier, and climbing down by a narrow gully ourselves. It would be very difficult to take a loaded sledge up here, and the Alfred Newton glacier at the mouth of the inlet forms a much better route into the interior.

Once down on the sea-ice our troubles were over, and after occupying a station on Baird Island we had finished our survey and had only to think of getting home. The depot at Wade Point was picked up, and after three uneventful days we reached Fram Haven on May 26. The route over Smith Sound was now very plainly marked, for in addition to our own tracks there were those of Haig-Thomas and Nukapinguaq, of the bear-hunting party, and of two members of the American expedition who had occupied a magnetic

station on the site of Greely's tragic camp at Cape Sabine. These parties had all met on their return journey, and had left almost a high road for us along the ice-foot on the Greenland side. Etah was reached early on May 29.

Coastal names

There are four main inlets on this stretch of coast; I call them from north to south: Baird, Cadogan, Talbot, and Makinson inlets. Of these Inglefield saw only the two southern, and named them Cadogan and Talbot. Hayes saw only the three northern, and of these he left Baird Inlet unnamed, and applied Inglefield's names of Cadogan and Talbot to the other two. He thus moved these names each one inlet to the north, and made the first of errors given authority and general currency by the U.S. chart of 1874. This chart was more detailed than any produced before, and showed all Inglefield's names, but almost all were in the wrong positions, owing to the initial mistake about the inlets (see Fig. 1).

With the exception of MacMillan's map of 1917, never adequately published, all subsequent maps and charts of this coast closely followed the 1874 chart. The locations of the names on it have therefore been in general use now for over sixty years. It seems to me that less confusion will be caused by trying so far as possible to keep to this usage rather than to go back to the original locations at this late stage. Moreover the exact placing of some of the original names must still be a matter of opinion. Insisting on historical accuracy would erase many of the names given by explorers after Inglefield, because they were applied to features which he had already named; and many new names would have to be found for features to which their discoverers wrongly gave Inglefield's names: what is now called Cadogan Inlet is the most important example.

The general scheme for placing coastal names has therefore been to apply them as far as possible in the positions which they occupy on the present-day British and American charts, and on the Canadian North-West Territories map. As the coast has been shown inaccurately in these maps such placing cannot be exact, but I have at least preserved the relative positions of the names, which seems to me the only way to avoid confusion.

Names in the interior did not present such a problem because nearly all of them were given by MacMillan, and his map is sufficiently detailed to remove any doubts about their correct positions. I have applied only such new ones as seemed essential, and have left unnamed a large number of mountain peaks which we fixed in position and height for the first time; their heights provide an easy way of referring to them. The interior is still only partially surveyed, and it remains for later surveyors to give names there, when a comprehensive map is eventually made.

Note by Editor G.J. The four paragraphs which follow have been condensed from the author's Appendix on Names, for which space in full could not be found. Any defects in these paragraphs should therefore be attributed to the Editor and not to the author, to whom it has not been possible to submit proof for approval.

Fig. 1 shows the relation of my survey of the coast and the names I have attached to its features with the charts of Inglefield 1852, Hayes 1861–62, Hall 1871–72, and MacMillan 1917. I have prepared a list of names with

their origin and history, which is deposited with the R.G.S. and with the Scott Polar Research Institute, Cambridge, for the use of students; a list of references is attached. For help in preparation of this list I am much indebted to, first of all, Rear-Admiral Sir Edward Inglefield, who placed at my disposal many of his father's original sketches; to Mr. J. M. Wordie; to the staff of the Charts Department of the Admiralty, particularly Miss Heather Cobley and Mr. Pascoe; and to the staff of the Library of Congress, Washington, who kindly sent me the history of names given by early American explorers.

The complete list was too long to print. A few points may be extracted. Baird Inlet is steep-sided, of marked fjord type, and clearly shown on Inglefield's drawings. On his chart is a glacier in much the same latitude first shown as an inlet on Hayes' map. MacMillan named three glaciers north of Baird Inlet from members of his expedition, Small, Green, and Allen. I have proposed to call the larger unnamed glacier after him. Major Gunnar Isachsen and Ove Braskerud explored the ice-cap north of the Ekblaw glacier on the second Norwegian Arctic Expedition. I propose their names for the tributary glaciers of the Ekblaw north and south.

From Inglefield's drawings and charts it seems he gave the name Cape Isabella to a conspicuous bluff on a straight stretch of coast near the Lyman glacier. The name was placed by Hayes south of Baird Inlet and I have kept it there for a low point about 150 metres high, rising abruptly to a conspicuous ice-capped mountain about 5 kilometres inland. The name Gale Point was, I think, given by Inglefield to what I have called Cape Faraday, but the name has been established in the present position since about 1874. Cadogan Inlet was the name given by Inglefield to what I have called Talbot Inlet. I propose the name Cadogan glacier for the large glacier at the head of Talbot Inlet. Paget Point was, I consider, given by Inglefield to what I have called Cape Hurd, but since 1874 has been used always in its present position. MacMillan gave to Cape Hurd the name Cape Dunsterville, which had been used by Inglefield in the neighbourhood of what I have called Eskimo Bluff. I have applied it to the prominent cape in about the same latitude. The name Cape Faraday was almost certainly given by Inglefield to what I have called Boger Point, but had been transferred by Hayes to about its present position. The name Talbot Inlet was given by Inglefield to what is now called Makinson Inlet on the Canadian map. The name was moved one step to the north in 1874 and I have left it there, proposing the name Talbot glacier for the glacier at its head. For the two upper branches of the glacier I propose the names Wykeham and Trinity. Mount John Ross is on Hall's and later charts shown as a high mountain behind what is there called Cape Faraday. As there is no such mountain behind what I have called Faraday the name has been put back to near its original position. Makinson Inlet was named after Constable G. T. Makinson, who discovered its full extent in 1928; it has been described in detail by R. Bentham. The mountains south of Talbot Inlet have been unnamed. I propose for this range the name Inglefield Mountains, taking the division between them and the Prince of Wales Mountains named by Inglefield as the Wykeham glacier. The new names which I have proposed have been approved by the Canadian Geographic Board.

APPENDIX: METHODS OF SURVEY

As there was no previous survey with which to connect, control was astronomical by sun observations with the Society's Wild Universal theodolite, which was fortunately brought back from the Antarctic just in time for us to take it with us.

Time was kept by a deck watch, also the property of this Society, carried in a bag which Hamilton wore slung round his neck underneath his clothing, where it was at a reasonably constant temperature, and kept a remarkably good rate. The watch was controlled by time signals about once a day, except between April 12 and 20, when no signals could be heard: a very severe magnetic storm was experienced at Etah and over most of Greenland. We used a short-wave wireless set made by Mr. Mathews, the Assistant to the Society's Instructor in Survey. It gave excellent service, and weighed, with batteries, about 15 lb. Hamilton made himself entirely responsible for the care of this wireless set and of the watch, and never failed to provide accurate time.

Our method of working has been described in detail in *The Polar Record*, No. 18, 1939. We established stations in pairs, a survey station in a commanding position, and the camp a short distance away at sea or main ice-cap level. Most of the sun observations were made at the camp, because the time that must elapse between them could be more profitably spent there. One or two would be taken at the survey station, which was connected to the camp by a subtense base, and these could be included with those taken at the camp to fix the pair of stations.

Very little connection could be maintained between the occupied stations, but in two areas, round Orne Island and in Baird Inlet, a few stations were connected by rough triangulation extended from subtense bases. A certain check was also given by the intersection of a few prominent inland peaks from several different points; these peaks formed the control for the inland survey. The small triangulation scheme in Baird Inlet included four stations also fixed astronomically. The triangulation fitted these positions almost perfectly on the plotting scale of 1/200,000. This was surveyed late in May, when the sun was comparatively high and temperatures about freezing-point.

The sights were worked out by Hamilton during the autumn of 1938, after his return to Thule, all except the circum-meridian latitudes as position lines. The original observations and computations are being stored at the Scott Polar Research Institute, Cambridge, where they will be available if required for more detailed treatment.

The mapping of detail

Detail was mapped either by short base work with the theodolite or by intersection from photographs with a camera attached to it.

Two stretches of coast-line, the south side of Easter Island, and the part of the glacier which lies between Cape Mouat and Eskimo Bluff, were mapped from horizontal bases set out on the sea-ice some distance from the land. The errors of these parts of the coast may in places be as large as a kilometre. Otherwise the coast was mapped entirely by depression angles. The heights of the stations from which these angles were taken were determined nearly always by direct measurement, and should seldom be in error by more than a metre or two. The tidal range along the coast appeared to be of about this order.

The least accurate portion of the coast plotted by this method is the stretch between Cape Mouat and the south-west corner of Easter Island, mapped from a station only 26 metres high on an iceberg. The error in the ray length may

exceed a kilometre. The coast near the head of Cadogan Inlet may also be in error by nearly as much, because it was mapped from stations over 20 kilometres away at the mouth of the inlet. At this distance the boundary between land and sea was not easily definable, nor was it always possible to determine whether the coast-line was formed of ice or snow-covered land.

Apart from these stretches the coast-line should be accurate to 100 or 200 metres relative to the control points, and therefore in all accurate to about half a kilometre. A few portions of the coast-line were mapped from two different controls, and the discrepancies between the two fixes was seldom more than this. A short stretch of coast, on the east side of Boger Bay, was not mapped at all by instrumental methods, but it is improbable that its position on the map is seriously in error.

The Ekblaw glacier and some of the land on both sides of it was mapped from a traverse run down the glacier from near its head. The rest of the map was plotted from photographs taken with a camera attached to the Wild theodolite. The idea was taken from the "Watts-Leica" used in the Mount Everest Reconnaissance Expedition in 1935.

An Exakta model B camera, with a Jhagee 3·5 lens, and taking 6 × 4 cm. film, was mounted on a removable table above the theodolite. Four legs were screwed permanently to the theodolite uprights in such a way that the theodolite would still go into its ordinary case. A rectangular plate rested on these legs, which passed through holes near its corners. They were clamped there by slotted strips which engaged in grooves running round the tops of the legs. A fifth hole in the centre of the plate took a small thumb screw which fitted into the hole already in existence in the base of the camera for attaching it to its tripod.

This attachment was made by Mr. E. S. Marsh, of the Unicam Instrument Company, Cambridge. The main principles of the design were suggested by Mr. Hinks and Professor Debenham. The camera attachment is now in possession of the Society.

In drawing the map, I first plotted all the information available from angle-books and sketches in the ordinary way; the photographs were then plotted on the same sheet. This turned what had been a simple delineation of the coast-line with a few spot heights fixed inland into a contoured map of the whole coast, together with about 1000 square miles of the inland topography.

The photographs were enlarged ($\times 2\frac{1}{2}$) by the Society's map mounter, all with one setting of the enlarger, and their effective focal length was determined with angles measured with the theodolite.

In almost all the photographs the collimation lines could be drawn directly through the marks at the edges of the picture, and angles could be measured with an accuracy of about 5 minutes of arc. This is rather higher precision than can be achieved with horizontal angles in plane-table work, but rather lower than that possible in measuring vertical angles with a clinometer or telescopic alidade. Such an accuracy made it necessary to correct for curvature and refraction in the longer rays, and made possible fairly accurate plotting of 100 metre contours in most areas.

I found it simplest to lay out lines corresponding to the optical axis and the horizon line of the enlargements directly on to the map, and then to transfer the distances on the enlargements to them with dividers. This method was recommended to me by Mr. Michael Spender. Identification was not found to be difficult.

'THE ENGLISH ATLAS' OF MOSES PITT, 1680–83

E. G. R. TAYLOR

THE history of the Library Atlas goes back to 1570, when the Flemish cartographer and scholar Abraham Ortelius published the first general world atlas, that is to say, the first set of maps specially designed and printed for issue as a bound volume. He entitled it 'Theatrum Orbis Terrarum': the term Atlas was borrowed from the title-page of a similar but later publication compiled by his friend Gerard Mercator, and quickly established itself as the general designation of a book of maps. Rather over a century elapsed before the first large general atlas to be launched in England was announced by the London bookseller Moses Pitt from his shop at the Sign of the Angel in St. Paul's Churchyard. It was to be called 'The English Atlas,' a title which John Ogilby had already used for the set of descriptive geographies (including his famous Road Book) which he began to publish in 1670. It is probable therefore that Pitt chose it for his own proposed atlas only after Ogilby's death in September 1676.

The new undertaking, grandiose in its scope (for six hundred maps on nine hundred sheets were at one time spoken of), was to prove a melancholy failure. Of the eleven volumes finally planned only four actually appeared, nor is a reason difficult to find. Moses Pitt was neither a scholar nor a cartographer: he lacked capital, he lacked suitable premises, he could not command the services of skilled map-draughtsmen, nor of qualified geographical writers. Hence while it is true that he did not lack good advice he was unable to profit by it. It was indeed idle for any English publisher to dream that he could, at a single bound, reach the level of the world-famous cartographical establishments of Holland and France, with their learned personnel and long experience.

Yet certain circumstances were in Pitt's favour, for by 1678, the date of his first prospectus, copies of the two most magnificent contemporary atlases, those of Jansson and Blaeu, both printed at Amsterdam, were rapidly becoming unprocurable. Both houses had ceased publication. In the case of the Blaeu atlas, this was due to a destructive fire in the printing house in 1672 followed not long afterwards by the death of the head of the firm. The last of the Janssons had died in 1660, leaving the business to his widow and his three sons-in-law, the brothers Waesberg, who also styled themselves Jansson à Waesberg. Not one of the co-heirs had the qualifications of the famous scholar-cartographers who had built up the reputation of the firm. The Jansson atlas had its origin in that of Mercator himself, enlarged subsequently by the work of two generations of the family of Hondius into which John Jansson entered by marriage. The Blaeus too had been scholars. The first founder of their Atlas, William Janszoon Blaeu, when commencing business as a young globe-maker, had studied under the famous Tycho Brahe himself.

By the middle of the seventeenth century the two rival Dutch atlases had alike reached the cumbersome dimensions of eleven volumes, and in 1661 Jansson's heirs took the practical step of publishing an 'Atlas Contractus' from the existing plates before allowing the greater work to lapse. The worn

plates were then bought in by one of the Waesberg brothers, Johann, whose partner in the bookselling and publishing business was a certain Stephen Swart. This Swart happened to be the Amsterdam correspondent of Moses Pitt, and thus it came about that (probably some time in 1677) he saw his chance of disposing of the plates. There had been, he told Pitt, editions of the great atlas in Latin, Dutch, French, Spanish, and Italian, some of which sold for not less than 1000 guilders, or £100 in English money. "And considering (wrote Pitt in telling the story of his undertaking) that our English nobility and gentry were not less curious and inquisitive into Geography than those of other countreys where it was so much valued, I conceived it might be an acceptable work to them to print an Edition in our English tongue; with this first thought I acquainted some of the Royall Society."

If we turn to the Diary of Robert Hooke,[1] the versatile Secretary and Curator of Experiments to that Society, we learn that he had an opportunity to examine Pitt's scheme on 20 March 1678, and that his comment was: "His design for Atlas good." He therefore took the first opportunity to escort the bookseller to the house of Sir Christopher Wren where the project was explained once more, with the result that on March 28 Pitt's proposals for an English Atlas were read out at a meeting of the Royal Society, Sir Christopher, as Vice-President, being in the chair. Again the project was approved, and a committee of seven Fellows was appointed to meet weekly and supervise the publication of the Atlas. As so frequently happens with committees, many of the members were not prepared for actual work, and it became necessary to supersede the committee by a board of directors, the most active members of which were Robert Hooke and Richard Lloyd, Dean of Bangor. The Dean however had many other matters to occupy him, and Moses Pitt had finally to make a private arrangement with Hooke whereby he was to pay him a fee of £200 in return for the actual passing for press of the maps and text.

Meanwhile Pitt had also got into touch with Dr. Fell, Bishop of Oxford, and on Lady Day 1678 had leased from him the Bible (as opposed to the learned) side of the University Press as from the following Michaelmas Day. In this transaction Pitt was associated with three other booksellers as partners, and these had nothing to do with the Atlas, so that in spite of what he later asserted, it is certain that the Atlas was not his sole or even possibly his main reason for acquiring the Press. The story of the Atlas and its failure can be pieced together from Hooke's Diary, from a number of his notes and a few letters to him that have been preserved among the Sloane Manuscripts, and from a few contemporary references in print, besides of course from the evidence afforded by the Atlas itself.

During the month of April 1678 there were meetings of persons interested in the Atlas project (not always either committee members or directors), at least three times a week; and Pitt must have realized at once the gulf between the respective viewpoints of himself and these men of learning. They were enthusiastic for an up-to-date atlas, he was anxious to profit by the reissue of an old Dutch one in an English guise. According to the notes that Hooke preserved, the Atlas was planned by the committee to be an advance on all its

[1] 'The Diary of Robert Hooke, 1672–1680.' Edited by H. W. Robinson and W. Adams. 1935.

predecessors in respect of systematically chosen scales and projections, as well as in respect of the incorporation of material from the most recent surveys and voyages of discovery. One of his suggestions runs: "The Atlas may contain about 200 maps viz:

2 of ye 1st scale, being ye two halfs of ye world covering a globe 14 inch diameter.

40 of ye 2nd scale, being ye cover of a globe 8 foot diameter.

160 of ye 3rd, being such parts of Europe and America as are well described for a globe of 90 ft diameter.

" 202 maps will make 8 volumes, each volume to contain 25 mapps at the least, with necessary tables of names and descriptions, soe as to make each vol. to containe 100 sheets of large paper. The 27 maps of the first vol. may easily be new graven and fitted as they ought to be within the time limited if five men be employed at the performance thereof, each of them doing one fifth part of the number or more, to wit 5 or 6 mapps. The engravers names to be . . ." Here Hooke leaves a blank, but judging from the evidence of his Diary, he must have had in mind Francis Lamb, who had considerable experience of map-engraving, Hermann Moll then only on the threshold of his career, his own young assistant Harry Hunt, a Dutchman named Cramer, and probably Gregory King who had worked in succession for Sir William Dugdale, for Ogilby and Morgan, and for John Adams.

But the cost of setting such men to do the work would have proved prohibitive. Dugdale paid Robert Vaughan from £2 10*s* to £6 10*s* for the extremely simple maps in his volume on Warwickshire (1656), and the copper plates for these (bought by weight at 4*s* the pound) cost about 9*s* 6*d* each. In a contemporary estimate for the cost of a county survey, probably that planned by John Seller after Ogilby's death, the cost of engraving is put down at £8 a plate, while the plates themselves were reckoned at 25*s* each. These county maps were comparable in size and detail with the plates in the English Atlas, and at a conservative estimate Hooke's scheme[1] of 202 maps "new graven" must have cost £1850. This sum allows nothing for preparing the map for the engraver, for the paper or for the accompanying text. As to the latter "Whilst these [the plates] are preparing, Mr. Cramer will prepare the necessary Indices. And Mr. Cluver the Descriptions in Latin which Mr. Philips will easily put into English. As fast as any of these are ready they may be printed off, the tables and definitions at Oxford, the plates and maps at London." Cramer was a Dutch engraver occasionally employed by Hooke, Dethlerus Cluver was a Dutch mathematician and inventor well known to Fellows of the Royal Society, Philips was a professional translator, to be employed presumably because Cluver could not write English. Here again there was no consideration of economy, and Hooke's very full notes on the method and content of each regional description indicate that in his geographical concepts he was centuries before his time. Observations of longitude and of the mercury barometer, descriptions of climate and weather, details of land utilization, of agricultural practice, of variety of soils, of minerals, mines and quarries, of roads and bridges, of ancient monuments and modern buildings,

[1] Possibly the "whole designe" mentioned in his Diary, 14 August 1678.

of the people, their numbers, occupations, customs, food, trade: these are but a tithe of the queries to which the text was to supply an answer, and this answer was to be supplemented by a list of the best books and the most recent maps relating to each region.

But all this was Utopian, not even a lifetime of research could have produced the atlas of Hooke's dreams, and meanwhile Moses Pitt was committed by his printed prospectus of 3 May 1678 to the delivery of volume I to subscribers on 24 March 1679. Advance subscriptions had been fixed at 40*s* for this volume, and Pitt had been required to give substantial guarantees to Sir Joseph Williamson, then President of the Royal Society and one of the Secretaries of State, that he would not default. When the appointed day arrived, despite Pitt's advertisement in the previous February that he was ready to go to press (actually only the first sheet was ready) he found it necessary to ask for twelve months' grace. Hooke has preserved a draft of his apology to the subscribers for this breach of faith, in which the bookseller declares that being at pains to ensure that the workmanship of the Atlas should be of the highest quality "I was at some thousand pounds charge to purchase the Presse and Stocke at the Theatre of Oxford now grown famous for good Printing, nor was I satisfyed to use the Letters I there found but had a new set w^{ch} cost me [blank] pounds. My greatest difficulty was to find such persons to perform the Descriptions as should be approved by the Gentlemen Directors, severall having attempted wthout engaging, on w^{ch} tryalls some considerable time was spent.[1] In November 1678 a very eminent Person of ye University of Oxford (whose modesty will not permit me to name him) freely offered his assistance, engaging to procure to have them done by able men there, and to take the charge upon him of perusing and correcting them. The doing of w^{ch} as it ought took up more time than I computed at first, which necessitated me to fail in the time proposed." The "eminent person" who stepped in was Dr. Fell, and he assigned the major tasks to William Nicholson, a young divine who subsequently became a bishop, and to Richard Peers, one of the Esquires Bedell. Dr. Todd and Dr. Obadiah Walker, Master of University College, also lent their assistance, and the result was the jejune text eventually printed. Inquiry in the field was replaced by inquiry into the books ranged on the shelves of Oxford libraries.

In respect of the maps also, Hooke was to meet with defeat. In what appears to be a minute of a meeting of the Committee he notes: "Concerning the mapps. 1. Concluded that all those plates of Johnson [*i.e.* Jansson] w^{ch} excell any other of y^{t} place shall be retained and made use of. 2. To take in all those other of Johnson w^{ch} are amendable and to adde those amendments. 3. Where these mapps are ill graven, ill described or ill situated or ill projected, to be laid aside and instead thereof either to make use of other maps of Visscher, de Wit etc. or to have them new graven wth all the amendments and corrections. 4. To reject all those tables and mapps w^{ch} shall be superfluous and redundant." When this decision was reached (probably on 30 November 1678), we have Hooke's own notes to show that he scrutinized Jansson's maps with the most minute particularity. Rarely was he satisfied: "Intollerable, having all

[1] Hooke had attempted to secure the employment of the younger Pappin for the task, and himself commenced to write an Introduction on 10 August 1678.

manner of faults"; "Old, worn out, exceeding imperfect, the meridians 8 degrees fals, full of old errours, in noe wise to be admitted"; "Worn out and will not last an impression"; "A very imperfect and fals map though ye graving be good." Of other plates however he could say: "good," "very good" or even occasionally "excellent."

Since Pitt had pledged himself to go forward with the Atlas so soon as he had a mere two hundred subscribers of 40*s* each, his arguments on the score of expense could not be denied. To meet them, Hooke had induced the bookseller to enter into a bond to give him a further £200 (over and above that to be paid for supervision) in return for which he would reveal a secret device for cheapening production. The device appears to have been the substitution of overprinting from movable type for engraved lettering.[1] It was not practicable, and one of the Fellows of the Royal Society, Sir John Hoskyns, expressed himself plainly to Hooke on the ethics of driving such a bargain. In point of fact however apart from a few pounds on account, Hooke never received any payment from Pitt for all the work he actually did in connection with the Atlas. In the Diary Moses becomes henceforth "That rascal Pitt."

Nevertheless the Directors were slow to abandon all hope of incorporating new material in the Atlas, and an incident is recorded which serves further to emphasize the vanity of such hopes in the face of Pitt's lack of substantial capital. It appears that a distinguished correspondent of the Royal Society travelling on the continent learned that the President of Copenhagen, Peder Hansen Resen, had made a collection of new maps and town plans of Denmark. He therefore tried to secure this collection for the Atlas, and induced Resen to send specimen maps for examination by the Royal Society, and to communicate directly with Pitt. The material (subsequently published as the 'Atlas Danicus') was practically ready for the press, and Resen was prepared to part with it for what it had cost him, namely 2700 rix dollars, or £607. On 1 May 1679 and again on May 8 these maps were on view in London, but Pitt for obvious reasons took no action. In fact the retouching of the Jansson plates was already under way and was being carried out in Amsterdam. Nearly a year previously, *i.e.* in June 1678, Steven Swart, when writing on another matter to Robert Hooke, had concluded: "Sir, excuse haest, wee have sent some maps, when see them, doutt not but wil give great satisfaction to your selve and the rest of the Direktors of our Atlas." The two conclusions to be drawn from Swart's words, namely that such minor alterations as were finally carried out on the Jansson plates were done in Amsterdam,[2] and that Pitt had entered into some sort of partnership with the firm of Waesberg and Swart ("our Atlas"), are confirmed by the inscriptions added to the printed plates. Many are marked: "Sumptibus Janssonio-Waesbergiorum et Mosis Pitt," others: "Ex officina Janssonio-Waesbergiana et Mosis Pitt," others again: "Apud Janssonio-Waesbergios et Mosem Pitt," or with yet a fourth variant: "Excudebant Janssonio-Waesbergii et Moses Pitt."

[1] "August 6th 1678.—Mr. Pitt gave me a bond to pay me £200 at Michaelmas next, upon which I told him my contrivance for the making mapps without graving names, but only printing them on sheets by." In principle the device was not new.

[2] Hooke has also a Diary entry on 10 December 1678: "With Pitt about maps from Swarts."

On the twenty-sixth plate of volume I the name of Steven Swart is added to that of the Waesbergs (father and sons) and Pitt, and henceforth throughout volumes II and IV (the third published) the three names always appear together. In volume III (the last published), which appeared in 1683 when Moses Pitt was in difficulties and betook himself to Ireland, the plates cease to bear any publishers' names at all, but it is apparent that the three names had been engraved as usual on the first three or four maps and then scraped out. There must have been a rupture of the partnership or agreement, no doubt because Pitt was unable to pay the Dutchmen their due.[1]

Whether the plates of volume III were finished in England it is impossible to say. All that is certain is that in the whole Atlas so far as published (four volumes of eleven) there was only one map, that of the Polar Regions, which was designed, drawn, and engraved in England. It bears the imprint "Oxford 1680," and may have been the work of Michael Burghers, one of the engravers to the Press.[2] The map of Norway, a Jansson plate, is signed by Francis Lamb, and the map of the world on Mercator's projection (not after Jansson) is inscribed "Janssonius à Waesberg & sons, Moses Pitt & Steven Swart," indicative of an English engraver. It is dedicated to Dr. Fell. These maps are in volume I. Plate XLIII in volume II has the imprint "Londini apud Mosem Pitt."

The text, as has already been explained, was eventually written and printed at Oxford, but it had to be submitted to the Directors, and this undoubtedly caused vexatious delays. In March 1680, in spite of action taken by the Royal Society, Pitt for the second time failed to deliver volume I on the appointed day. Two letters which he wrote to Robert Hooke a week or two later give so clear a picture of the difficulties under which the unfortunate man laboured that they will be transcribed in full. The first is dated from Oxford on April 5:

"S^{r}, My L^{d} B^{p} [Dr. Fell] and M^{r} [Obadiah] Walker ar both very well pleased wth what you have done, and y^{e} M^{r} bid me to tell you that he will take it very kindly if you please to acquaint him with any alterations or additions you shall be pleased to make in both the Preface and Introduction, but they [are] both very nie to the finishing of the 1st volume. And ar of the Judgement that the Introduction must be to this 1st volm, and if you please to minde the proposals you will find that the introduction is promised to this volm. I hope both the Title and Dedication will be composed within 2 days, and I will send them you before they ar wrest of[f] at the Press. All Denmark will be done tomorrow or wensday, so that we shall want the Preface and Introduction w^{ch} I pray give M^{r} Pullen [the carrier] or Sam who will take care to convey it me. At ye end of the Preface I will print ye proposalls and at the end of them ye subscribers names and then the introduction onless you

[1] A copy of the Atlas offered for sale by Orion Booksellers, Ltd., bears the imprint: "Oxford, for J. Janssonius a Waesberge and S. Swart, Booksellers in Amsterdam, 1680–82," instead of the usual: "Oxford, Printed at the Theater for Moses Pitt." This lends support to the view of a breach after 1682.

[2] Hooke's notes: "North Pole: Sellars or rather New," "Drew Polar projection," "Drew projection at home with Lamb," and "Pitt paid Lamb £3 for draughts" may refer to the drawing of this map.

ar pleased to order the contrary. The Mr [Walker] will make the Index of mater after the manner you mention. I pray, Sr, fail not to send ye Preface and Introduction.

Your most humble servt

Moses Pitt.

I should be glad to hear what you did this day."

Hooke's reply (written on April 9) is not available, but it is clear that he considered it necessary to submit the Preface to his fellow director, the Dean of Bangor. In a letter dated April 25 Pitt therefore writes as follows:

"Mr Hook, I pray Sr doe me ye favour to speak to ye Dean, yt I may have the Preface, for now I have done all but yt and pt of the Index. I pray send me word if you please to answer for ye subscriptions of Mr Boyle, Mr Chase, Mr Hill, Sir Jo. Hoskins or what other of your friends you can assure yourselfe of. You told me you would get Xt church to subscribe for ye Boys [the Christ's Hospital Mathematical Boys]. Yesterday we began the 2d volm, a sheet of wch I will send as also the map of Greenland wch will be finished tomorrow. I am yr most humble servant Moses Pitt."

The office of a Director had proved no sinecure: the first sheet of the Atlas had reached Hooke in February 1679, and on Sunday 26 September 1680 he wrote in his Diary "Finisht Atlas." Volume II was in preparation, but he had severed his connection with the venture which had turned out so differently from what had been expected and hoped. The sad confusion into which it fell may be judged from the "Advertisement to the Reader" which Pitt inserted on p. 150 of Volume II (1681): "Some of the errata may be excused by considering the different times wherein several Paragraphs of the Book (seemingly contradictory) were pass'd. For example: Twas true (in the year 1680 when the sixth sheet was printed) that etc. etc." The unpaginated indexes also point to the breakdown in organization which wrecked the Atlas. Yet Moses Pitt was hardly blameworthy. As the letter quoted above suggests, the list of subscribers was a much longer one than the list of subscriptions actually received. Even the Royal grant of £300 from the Privy Purse was not actually paid over for some years, and it is probable that Pitt was no more fortunate in respect of the patronage of the Queen, the Duke of York and his Duchess to whom the three subsequent volumes were respectively dedicated and presented. As to the Duke, Samuel Pepys has a malicious anecdote in his *Naval Minutes*. "Mr Nott [the Queen's bookbinder] tells me that Mr Pitt's new Atlas has the very Dutch words and Dutch arms not taken out of the maps. And the D[uke] of Y[ork]'s taking notice to Pitt, when he presented it to him, of the maps being too small and close a letter, who answered Yes, but that they had a very fair margin."

Moses Pitt's arrest in 1685 and his later imprisonment did not arise out of his losses in respect of the Atlas, but from some disastrous ventures in the property market. In his 'Cry of the Oppressed' written in 1691 he declared that the sum of £150 would suffice to complete the fifth volume, which would then bring in £1500, while the sixth volume, too, was partly ready. The text of these volumes had in fact been set up in type, and one proof copy is extant, but no further support for the 'English Atlas' was forthcoming from the English gentry. Ralph Thoresby, of Leeds, made some inquiry about it in

the following spring, and William Nicholson, by then Dean of Carlisle, replied as follows: "About the English Atlas there were only four volumes finished. I wrote two of them: those that refer to Germany. M^r^ Perse [Peers] one of our Esq. Bedels wrote that of the Low Countries. The first volume was by several hands: the Introduction by a Fellow of Pembroke College: Greenland, Russia and the countries under the Pole were described by Obadiah Walker: Sweden by D^r^ Todd, then Fellow of University College, now one of our Prebendaries at Carlisle: Norway, Iceland, Denmark and Poland were done by me. D^r^ Lane of Merton began a volume of the Turkish Empire: and Moses Pitt (the undertaker) treated with me for finishing that part. In order to which he sent me down the Doctor's sheets, and I had provided such helps as I thought might enable me to bring it to perfection. But soon after my friend Moses fell into decay, and so the whole design was blasted."

NOTE ON THE CONSTRUCTION OF THE KARAKORAM MAP TO BE PUBLISHED EARLY IN APRIL

SOME years ago there was much discussion at meetings of the Royal Geographical Society and in the *Geographical Journal* on the question of range names in the Karakoram, and it became apparent that a map of the area drawn with special regard to the representation of the higher relief would be helpful in coming to a conclusion. A map was therefore compiled and drawn at the R.G.S. by Mr. F. J. Batchelor, the senior draughtsman, working under the instructions of a Committee appointed by the Council of the R.G.S. and under the constant supervision of Professor Kenneth Mason.

This preliminary edition had a certain number of peak, pass, and river names, enough to make the country recognizable. It was circulated to many travellers who had contributed to discussion of Karakoram Range and Peak names, and their suggestions were considered by a Conference in London between representatives of the Survey of India and the R.G.S. during the winter of 1936–37. A full account of the preliminary work and the Karakoram Conference Report was published in the *Geographical Journal* for February 1938. The names now shown upon the map accord with the decisions of this Conference, which were subsequently approved by the Surveyor-General of India.

Meanwhile exploration had been active and considerable additions to the first compilation were made, to include all published results up to Mr. Eric Shipton's Karakoram Expedition of 1937. The Map has been drawn on the principles described in a Note communicated to the International Geographical Congress held at Warszawa in 1934, of which the following is a summary:

Our task was to produce on the scale of 1/750,000 a map of the Karakoram with an altitude range of about 3000 to 28,000 feet. Unrestricted by any conventions we have sought the most graphic method of representing the relations of the high mountains and great glaciers to one another and to the deep valleys which divide the different massifs.

After many experiments we have abandoned the layer system. The strong red or brown warm colours of the normal scale combine badly with the blue and white required in the representation of *névé* and glacier. We tried without success to find a colour scheme which should pass into cold greys for the higher altitudes below the snows. And we concluded also that no layer tints are satisfactory when the contours are close. Unless the distance between contours is at least 5 mm. the tint of the layer is affected by the colour of the contour. Hence we renounce the use of layer colours for the heights, reserving the possibility of using them in the valley bottoms.

In principle we accentuate the mountain slopes, colouring those which are bare in brown on a ground tint of yellow with blue shading of the snows and in addition a general oblique purple shading. The hill shading is in principle cast from the north-west, as is usual; but we reserve the liberty to vary its direction somewhat to suit the ground, as was done long ago by the Swiss cartographers. The system much resembles that used in recent Norwegian maps, adapted to the higher altitudes.

For the valleys we have adopted tints of greyish green and have been careful not to carry the hill shading down into the valley bottoms. The idea was derived from the old habit of the Austrian cartographers in colouring *Thalsohlen* green on maps otherwise uncoloured.

For the names we adopt the new Ordnance Survey alphabet as nearly as we can, and use the one style of Roman and sloping throughout. Peak names are distinguished not by a different character but by writing them along the arc of a circle above the summit, with the height symmetrically below, so that the position of the summit is always in the same relation to the name and the figures. By analogy we write pass names above the pass symbol in the general direction of their route, with the pass height below. The framework of the map is the triangulation of the Survey of India; their topography has been modified and extended by the results of recent expeditions.

The map is printed in eight colours on a sheet with engraved surface 22·7 by 20·0 inches. The scale is 1/750,000 or 11·8 inches to 1 mile. The price of the map is 7*s* 6*d* or 5 Rupees to the public, to Fellows of the Society 6*s*. Copies of the preliminary edition, without mountain names, may be bought from the Office of the Society for 2*s*.

REVIEWS

EUROPE

THE BRITISH ISLES. By A. DEMANGEON. Translated by E. D. LABORDE. (First published in French in 1927.) *London: William Heinemann*, 1939. 9×6 *inches;* xviii+428 *pages; illustrations, sketch-maps, and diagrams.* 15*s*

Thirteen years ago M. Demangeon's 'Les Iles Britanniques' was something of a pioneer work on the geography of these islands. The only volume of comparable scope was Mackinder's 'Britain and the British seas,' then over twenty years old and, although still valuable for its fundamental geographical principles, clearly in some respects out of date. Moreover the body of periodical literature on British geography which had accumulated was meagre, whilst large-scale regional monographs comparable with the excellent series of French works were virtually non-existent. The magnitude of the task which confronted a Frenchman attempting to write a detailed geography of Britain will thus be readily appreciated, and no English geographer would wish to minimize the importance of M. Demangeon's work. Nevertheless, after more than twelve years' additional accumulation of knowledge and experience it appears, even though revised, in parts a little thin, sometimes rather elementary, and, especially on the economic side, somewhat unsatisfying. Its greatest value at the present time lies undoubtedly in the descriptions of English landscape and life which, like the photographs, have well-chosen viewpoints, and are frequently enhanced in value by comparisons with France and by observations on things which to us would seem commonplace but which to a foreigner are worthy of remark. Especially commendable is the chapter on London.

The volume under review is however more than a mere translation of the original work. M. Demangeon has endeavoured as far as possible to bring the book up to date, and certain passages, such as that on pp. 363–6 relating to recent economic developments, have either been re-written or are quite new. All the maps and diagrams of the original have been retained, and their clarity is well maintained except in one or two cases (*e.g.* Fig. 59); some have been redrawn to incorporate recent developments. Almost all the photographs have been reproduced, though mostly smaller in size owing to the different format, and the book is almost worth buying for this magnificent collection of pictures, drawn from many different sources, including the author's own camera. All bibliographical references however have been omitted.

Dr. Laborde's translation is couched in a flowing style which captures the spirit of the original, though certain blemishes mar the general accuracy. The most serious of these, and the most elementary, is the consistent rendering of *schistes* by the English "schists." The English geographer feels an acute twinge on reading that the Welsh mountains, parts of the Lake District, and the Southern Uplands, are composed of schists and not slates. Then on p. 295, "argile à silex" (the French equivalent of "clay-with-flints") is rendered as "siliceous clay," and on p. 297 Wadhurst Clay, the name of a stratigraphical division of the Wealden series, is transformed into "infra-cretaceous clay near Wadhurst." The rather surprising statements on pp. 265 and 286 regarding the "dry, rocky" surface of the Cotswolds, on which "bare rock appears through the soil at every step," are apparently however misconceptions on the part of the author and not translator's errors. But the "octagonal" basalt columns (a physical impossibility) referred to on Plate IVa and p. 121 are not in the original at all, and are presumably the translator's own invention. On

p. 72, "increase" appears for "decrease," on p. 139 "spindles" for "looms," and on p. 286 "worsted" for "woollen."

Turning to the actual matter of the book, the least satisfactory section, perhaps, is that on climate, which is rather elementary and furnished with many surprisingly antiquated statistics. Why a figure of 86° in the shade in 1883 should be quoted as an example of extreme heat in south-eastern England is not very clear to a native of that part of the country (and the original gives the date as 1833). There are however occasional good descriptive flashes, and the maps which form Figs. 22 and 23 are a pleasant advance on their predecessors in the original.

One feels a little unsatisfied with the inaccurate trans-Pennine section on p. 182: Mackinder's simple anticline has outlived its usefulness. It is a pity, too, that the stock phrase "inherited skill of the workers" (which is not quite an exact translation of the original) should have been allowed to remain (p. 179).

It is inevitable that, considering the rapid developments during the last decade and the paucity and scattered nature of good statistical information relating to industry, there should be numerous statements throughout the book to which exception might be taken. Many of the following however are misconceptions translated from the original which the last decade has not altered. The statements about the location of Scottish smelting plant are badly out of date (p. 172), but this is not surprising in view of the errors on Fig. 75. Bury is hardly a coal-mining town; the haematite of the Furness district was certainly in use before the middle of last century (pp. 193 and 357). It is hardly true to state that "the greatest expansion of the metallurgical industry (in Middlesbrough) dates only from the exploitation of the Thomas process" (p. 197). This might be true of Lorraine, and even of the Ruhr, but in Middlesbrough the acid steel industry was already well established and the basic process was for a long time subordinate. The statement that Yorkshire "has not surpassed either the Cotswolds or the Tweed" in the production of woollens is most extraordinary (p. 210), especially in view of employment and spindleage figures given on the same page and elsewhere. Sheffield has no blast furnaces (p. 212); and it is certainly untrue to say (p. 213) that it suffers from the absence of a navigable waterway. It is unfair to the port of Hull to quote only tonnage figures (p. 216), which make it sixth port in Britain, whereas by almost any other form of reckoning it has long been third. The South Wales coalfield is certainly not 7900 square miles in extent (p. 237), and the statement on p. 239 that "blast furnaces remained in the north-east . . ." is meaningless unless a date is given. The phrase "iron mines sunk into the foot of the oolitic limestone hills" is a most misleading description of the Jurassic ironstone belt. If Cleveland is referred to, the hills are not limestone and the mines are not, and never were, at their foot; and if Lincolnshire, Northamptonshire, and Leicestershire are meant, the quarries (rarely mines) are not at the foot of any hills, but are on the top of a small scarp or else on a broad dissected plateau. Birmingham is not sufficiently differentiated in its history and geographical setting from the Black Country (pp. 272–5), and it is surprising to read that this metropolis of canal navigation "can neither send nor receive goods except by rail"; surprising, too, that in this chief home in Britain of non-ferrous manufactures, "human life depends wholly on iron and coal" (p. 274).

The third part of the book (the first part is a general survey and the second regional studies) is devoted to economic and imperial geography. The latter is good, and one may be grateful for the French interpretation of the Empire given on pp. 395–410; but the part as a whole necessarily involves a good deal of repetition, and is withal rather thin. So much literature on British agriculture

has become available during the last few years, notably through the products of the Land Utilization Survey, that this section (pp. 337–49) appears very jejune, and it is a great pity that the almost meaningless, so-called "distribution" maps of cattle and sheep, based on county statistics only, should have been allowed to remain. M. Demangeon is very shaky on iron and steel. Iron and steel production is confused with iron and steel using (*i.e.* engineering), and as a result the geographical factors are missed or falsely interpreted. Birmingham is falsely emphasized as a producer of iron, which it has never been; and the reviewer counted fourteen separate errors on Fig. 75, a map of British blast-furnaces in 1938. Some of these, it is true, such as the misnaming of Carron as Grangemouth, and of Rotherham as Sheffield, are perhaps not very serious, but it is certainly unfortunate that Frodingham, second smelting centre in the country, should be shown as having less than five furnaces, and still more unfortunate that the biggest symbols in Scotland should represent works which have been extinct and partly demolished for nearly twenty years. The map of iron-ore workings (Fig. 77) is apt to be misleading without a date; it appears to relate to about 1918–19, when iron-ore extraction was artificially stimulated in many uneconomic areas; if each dot means one mine or quarry the number of dots is about twice the present actual figure, and their distribution should be much less wide.

S. H. B.

THE FARMING YEAR. By J. A. SCOTT WATSON. *London: Longmans*, 1938. $7\frac{1}{2} \times 5\frac{1}{2}$ *inches;* 144 *pages; illustrations.* 7*s* 6*d*

FARM AND SCHOOL. By J. O. THOMAS and A. VOYSEY. *London: Longmans*, 1939. $7\frac{1}{2} \times 5\frac{1}{2}$ *inches;* 112 *pages;* 90 *illustrations.* 5*s* 6*d*

The Professor of Rural Economy in the University of Oxford has written, primarily for schools, a simple lucid account of the varied types of farming found in Britain. Its authorship ensures a standard of accuracy and a depth of knowledge unusual in such books, and there can be scarcely a man or woman incapable of deriving both profit and pleasure from its perusal—especially at a time when the life of the nation depends so largely on an intelligent use of the land. Encouraged by its immediate success the publishers have now issued another volume in the same format, also copiously illustrated, which is a practical guide to present-day farming, addressed to schools and Young Farmer's Clubs.

L. D. S.

OXFORD. As it was and as it is to-day. By CHRISTOPHER HOBHOUSE. *London: B. T. Batsford, Ltd.*, 1939. $8\frac{1}{2} \times 5\frac{1}{2}$ *inches;* x+120 *pages; illustrations and plan.* 8*s* 6*d*

Mr. Hobhouse's justification for adding to the books on Oxford must be the straightforwardness of his tale and the brevity, often epigrammatic, of his style. In thirteen short chapters he runs through the history of the university from St. Frideswide to Nuffield College. He comes quickly to the establishment of the first colleges, plunging at once into a description of the buildings erected in each epoch, and including the sorry story of modern architecture from Balliol to North Oxford and Rhodes House. The method perhaps was mistaken, for not all the buildings of Oxford will stand the strain of individual examination. It has led Mr. Hobhouse to praise for Hawksmoor's celebrated pepper castor in the High, for the baroque porch of St. Mary's, and for other features better left enveloped in the Thames valley haze which he recognizes as the main constituent of Oxford's appeal. Generally however Mr. Hobhouse ignores the natural setting; the visitor will find him a readier guide to interior beauties such as the Library at Queen's, or the fan-vaulting at Christ Church. The visitor will

find too that much of the history of the university is skilfully woven round the story of the buildings, the main traits of each epoch being often deftly summarized. The complete stranger will be helped by the many illustrations, ranging from air-photographs to reproductions from Loggan, Ackermann, and others. The last chapter, on the recent trend of studies in Oxford, though it has little to do with the rest of the book, justifies itself. Geographers may complain that no attempt is made to integrate the city culturally or economically with its environment, that it is regarded almost as though it stood detached and aloof from the world; those who echo Mr. Hobhouse's closing sentences will pardon the fault. J. P. H. M.

MANUEL HISTORIQUE DE LA QUESTION DU SLESVIG, 1906–1938. By FRANZ DE JESSEN. *Copenhagen: C. A. Reitzel—Paris: A. Pedone*, 1939. 10½×7½ *inches; 902 pages; maps and diagrams.* £1 12*s*

This monumental work is a continuation of a previous one published in 1906 by the same author. It is divided into three parts covering the periods 1906–18, 1918–20, and 1920–38. The list of collaborators shows that the work has authority, and examination of the contents that little has been overlooked.

Agriculture is the mainstay of the people, and farms of 20–100 hectares in extent form the largest category. During the years 1906–18 the railway mileage greatly increased, especially in the departments of Haderslev and Angel-Slesvig. When North Slesvig was in the hands of Germany, the population was practically stationary, although the proportion of those under eighteen years tended to increase. Part II is largely composed of documentary evidence and a day-to-day chronological index. It is illustrated by a number of maps showing the results of the Slesvig Plebiscite of 10 February 1920 and the various lines suggested in the endeavour to fix a boundary. Article 114 of the Treaty of Versailles finally replaced Article 8 of the Treaty of Vienna 1864.

Part III deals with the post-1920 fusion of North Slesvig with Denmark. It is of necessity largely concerned with legal enactments, such as those affecting the German minority. From 1921–35 the population of North Slesvig increased 9·9 per cent. as compared with 13·4 per cent. for the rest of Denmark. Out of a population of 184,700, 23½ per cent. are found in towns such as Haderslev, Aabenras, Sønderborg, and Tønder. If West Jutland be excluded, North Slesvig is the least-peopled part of Denmark. Occupations also differ from the rest of Denmark although these differences are being reduced:

	1921		1930	
	N. Slesvig	*Denmark*	*N. Slesvig*	*Denmark*
Agriculture ..	43·2 per cent.	33·3 per cent.	38·5 per cent.	30·0 per cent.
Industries ..	19·6	29·2	21·9	29·0
Commerce ..	7·9	10·0	8·2	10·8
Transport ..	6·0	6·8	6·5	7·1
Others	23·3	20·7	24·9	23·1

Agriculture is changing from pasturelands to a more intensive use with cereals and root crops; there is however a marked increase in the number of pigs and poultry, especially on the smaller holdings. The figures for transport show a decreasing number of vessels using the ports but an increased tonnage; rail transport is being ousted by road.

Prior to 1914 North Slesvig was a prosperous land, but the removal for military service of all able men up to forty-five years old and the post-war depression led to a difficult period of transition for the new regime; difficulties which were not helped by the parcellation of land. The land holdings were

smaller than the rest of Denmark and, as the map on p. 803 graphically shows, farms besides being small in total area were split up into several portions isolated from the farm-house. The law of 1924 gave powers to a Commission to rearrange the land and to encourage improvements.

This volume is to be recommended as the standard work on the frontier land of Germany and Denmark. There is much of immediate value to the geographer, apart from chapters on topics more remote from but still vital to a study of the region, such as religion, finance, and education. A. C. O.

THE ECONOMICS OF SOVIET AGRICULTURE. By LEONARD E. HUBBARD. *London: Macmillan and Co.*, 1939. $8\frac{1}{2} \times 5\frac{1}{2}$ *inches;* xii + 316 *pages.* 12*s* 6*d*

It may safely be asserted that during the past twenty-five years Russia has aroused more widespread interest than any other country; on some minds indeed the interest has amounted to a fascination which has paralysed all critical faculty or even any desire to reach the real facts. From this point of view Mr. Hubbard's book is one of the most useful that has appeared on the subject in recent years. He is well qualified for his task: he has lived and worked in Russia where he was associated with business and the Consular Service; he knows the language and the people. He has made a detailed study of the mass of official statistics and regulations and has presented the information simply and with a clear indication of the limits within which the figures are likely to be valid. In this volume of 300 pages he has succeeded in giving a great amount of detail not easily obtainable elsewhere.

He deals almost exclusively with the countryside, justifying himself on the grounds that about 70 per cent. of the population of Russia depends on the land for its livelihood; that agriculture furnishes over 50 per cent. of the total budget revenue, though according to Gosplan in 1933, only about 16 per cent. of the national income. It rarely interests foreign visitors who as a rule keep to a small section of three or four towns, but it is at the basis of Russia's life. The author wisely adopts the historical approach to the present-day position, and in his early chapters he draws attention to certain similarities between conditions to-day and those in the time of Peter the Great. He describes in some detail the period between 1905 and 1914 when agriculture was advancing fairly rapidly, and he discusses whether the peasant would by now have been better off if there had been no revolution. An important section is devoted to the period from 1917 to 1927, so interesting to look back on but so terrifying for those who lived through it. First came the establishment in the countryside of Communism under which the peasants had to give up all grain in excess of a very modest quantity, in exchange for the promise of manufactured goods which they frequently did not receive. They sullenly refused to work this one-sided arrangement and in 1920 reduced their sowings considerably; a severe drought set in and a terrible famine followed in which millions died. This caused Lenin to reverse his policy and readmit private trading: the New Economic Policy was introduced in March 1921 which reduced the compulsory deliveries to a fixed quantity and left the peasant free to produce as much more as he liked and to sell it as he liked. Some of the strict communists objected, but Lenin purged the Party and expelled 25 per cent. of its members. The event proved his wisdom; Mr. Hubbard gives figures showing that production increased greatly.

But the Party never liked this tampering with principle, and after Lenin's death they reversed the decision; they were influenced also by the fact that the peasant population was increasing, and people were drifting into the towns to look for work: by 1927 about 1·3 million persons, mostly peasants, were seeking

work in industry. So collectivization was introduced as part of the great change involved in the Five Year Plan. Partly through inherent defects, but more through bad management, it caused enormous losses which anywhere else would have broken the regime; in the first four years the live stock of the country was reduced to about half and about 5 million people had been deported to Siberia and the far north, where many of them perished. The land became so neglected that the droughts of 1931 and 1932 were disastrous; Mr. Hubbard estimates that some 4–10 million people died of starvation and the diseases induced thereby; about 12 million seem to have disappeared altogether.

Since then there have been modifications and the system is now working better.

The constitution of a collective farm is very fully described, the actual Russian order being fully translated. Full information is given about the motor tractor stations, the method of payment, and the system of brigading which plays an essential part. The collective farm however is not the final solution. The reviewer has been repeatedly informed by Russian experts that it is not theoretically sound; it is not communism but only socialism, and therefore it must sooner or later go.

The author concludes that the average collectivized peasant may have more to eat and to drink than if he had remained independent, but he has lost the spiritual values that differentiate the peasant from the urban proletarian: the link with the land, the spirit and practice of craftsmanship, the peasant lore, the singing and the dancing, the love of colour and of design in dress and household things. He thinks it almost certain that the new generation of peasants will be more like the town workers: without land or home ties or the urge to beget children, and he foresees a large reduction in birth-rate in consequence.

The book can be strongly recommended as a clear and dispassionate study of the available evidence, and the reader who prefers to draw his own deductions can easily do so because of the sharp separation between facts and inferences.

E. J. R.

ASIA

STRADE E COMMERCIO DELL' IRAN. By Elio Migliorini. (Istituto Italiano per il Medio ed Estremo Oriente.) *Messina and Milano: Casa Editrice Giuseppe Principato*, 1939. $8\frac{1}{2} \times 5\frac{1}{2}$ *inches;* 148 *pages; sketch-maps and diagrams*

This little book of facts and figures gives a general idea of economic conditions in Iran. Signor Migliorini describes the development of roads and railways, and the growth of industry and trade, under the present regime. The importance of the reforms introduced by Shah Riza Pahlevi is reflected in the vastly improved ways of communication. Under his predecessor, the number of roads suitable for vehicles was almost insignificant in comparison with the size of the country; and the only railways were those built by the British and Russians—not, the author suggests, with a view to linking up the various provinces, but merely as "lines of penetration that would secure new markets," to the exclusive advantage of the foreign Powers. To-day some 25,000 kilometres of roads suitable for motor traffic are available, and the Trans-Iranian Railway has established communication between the provincial centres and connected them with the capital. These improvements have not been made in order to expand Iran's foreign trade; the government's policy is to make the country self-supporting before attempting to find new markets abroad. The statistics regarding agriculture and industry would indicate increasing prosperity.

F. M. M.

THE BAIGA. By VERRIER ELWIN. With a foreword by J. H. HUTTON. *London: John Murray*, 1939. 9×6 *inches;* xxxii+550 *pages; illustrations and sketch-maps.* 30*s*

This account of a tribe of the Central Provinces of India is one of the best general descriptions of a primitive culture which has yet appeared. To its production the author brings prolonged experience of the people; a style of presentation which is clear and readable; and above all a grasp of current trends in anthropological research, reinforced by a keen appreciation of the native point of view.

Mr. Elwin reviews systematically all the major phases of Baiga life. His outstanding contribution is the chapter on *bewar* (shifting cultivation) and the effects of its prohibition on Baiga life. It includes a comparative section which is of special interest at the present time, when the requirements of soil and forest conservation conflict with native custom in many parts of the world. The Baiga evidence should be considered before thoughtlessly condemning "wasteful" native methods of cultivation without realizing how these are bound up with the lives of the people who practise them.

In his final chapter the author discusses the prohibition of *bewar* and other practical issues in relation to the future of the Baiga. "The *first* necessity is the establishment of a sort of National Park, in which not only the Baiga, but the thousands of simple Gond in their neighbourhood might take refuge" (p. 515). It is important to stress the word italicized by the reviewer in this quotation, for Mr. Elwin does not want an "anthropological zoo." He envisages a more positive constructive policy to follow upon the protection of the Baiga from official repression and the depredations and fanaticism of other Indian peoples. It is a pity that this scheme is not described in detail. Mere segregation seems an inadequate policy for a people who are among the poorest in the world, whose average life span is a little over twenty-five years, and whose capacity to cope with the diseases afflicting them is typified by their use of black pepper as a remedy for syphilis. But segregation would be preferable to the present deleterious policy, the cruelty of which is fully demonstrated by the author.

The introduction to the final chapter calls for two criticisms, directed rather against current anthropological misconceptions than against the author's work. His discussion of practical problems is introduced almost apologetically, as though it was not altogether respectable for the anthropologist to discuss what really exists (namely the cultural clash of human interests which to-day dominates the primitive scene) or to make suggestions which might be useful in the solution of real human problems. Whereas in fact it is the business of every scientist to collect information, as Boyle wrote of the nascent Royal Society, "according to the principles of our new philosophical colledge that values no knowledge but as it hath a tendency to use." Secondly, Elwin does not think "that the field-worker should concern himself with anthropological theories, but should confine himself to recording evidence" (p. 511). So far as "theory" refers to disputation about such things as the nature of animism or the origin of totemism it is futile in any case. But modern theory is a charter for research, and so far as an ethnographer records relevant material, he is inevitably concerned with theory. As distinct from ethnographic gossip, "evidence" implies problems upon which it has a bearing. The task of theory is to formulate these problems and to direct the collection and presentation of material in relation to them. Fortunately the author's practice generally negates his erroneous statement of principle, though the book would have been improved by a greater discrimination in the selection of material for presentation and a clearer formulation of ethnographic issues and problems. R. P.

L'ART KHMÈR CLASSIQUE: monuments du quadrant nord-est. By HENRI PARMENTIER. (Publns. Ecole Française Extr. Orient. XXIX *bis*. 2 *vols.*) *Paris: Editions d'Art et d'Histoire*, 1939. 11×7 *inches;* 364 *pages;* x+LXXIII *pages* (*plans*)*; illustrations and plans* 275*f.*

M. Parmentier, although he has now retired from the active service of the Ecole Française d'Extrême-Orient, is happily still continuing his valuable studies of Khmer art and architecture. In vols XXI and XXII (together with a Supplement in vol. XXXV) of the School's Publications he has already completed his work on the earliest forms of Khmer, the Primitive or pre-Angkorian, art. In the volumes under review he presents us with the first-fruits of his profound and detailed studies of the classic period of Khmer art, dating from the beginning of the ninth century (the foundation of Angkor) right up to the fifteenth century, which marks the close of the Khmer Empire. For the purpose of studying the classic art of ancient Cambodia he has arbitrarily (as he says), but in default of any known political or geographical divisions, partitioned the state into four quadrants, taking his centre line through the city of Angkor Thom, but reserving on one side the Angkor group itself, which will be the object of a separate work.

The present volumes are devoted to the study of the monuments in the north-eastern quadrant, which includes north-eastern Cambodia together with a neighbouring region of the French Lao states. The principal monuments in this section are the group of Koh Ker which have never yet been the object of any serious study, the temple of Prah Vihār, the temple, Vat Ph'u, situated near Bassac on the Mekong, the temple of Banteai Srei, about 20 kilometres from Angkor, and the temple of Khna Sen Kev. Koh Ker, which is situated approximately 14° N. by 104·5° E., was for a short time the capital city of the Khmer Empire. Practically all the monuments in this city bear dates of the reign of Jayavarman IV early in the tenth century. This district is now deserted, and it is still a matter for conjecture why this king removed his capital from Angkor to such a poor and sparse region. The monuments and sculpture are of a definite character however and provide an excellent guide to this particular period of Khmer art and architecture.

The temple of Prah Vihār is situated on a mountain in the Dang Rek range, and covers a distance of about half a mile rising to the actual summit. A short account of this remarkable achievement of the Khmer was published by the present reviewer in 'Indian art and letters,' vol. VIII (New Series), No. 2 (1935). The temple, Vat Ph'u, has also been visited by the reviewer and, from its situation on a hill, commands a wide view over the surrounding plain. The temple of Banteai Srei is well known to all visitors to Angkor, and, though in miniature, is one of the most exquisite examples of tenth-century architecture and sculpture.

All these temples and a number of other less important ones are described with a wealth of detail, and the illustrations, as well as the volume devoted to the architectural plans, are as complete as they can be made. The whole work is a monument to M. Parmentier's industry and skill. R. LE M.

AFRICA

THE CAMEROONS AND TOGOLAND: a demographic study. By ROBERT R. KUCZYNSKI. Issued under the auspices of the Royal Institute of International Affairs. *London: Oxford University Press*, 1939. 9½×6½ *inches;* xviii+580 *pages; sketch-maps.* 30*s*

Dr. Kuczynski's book runs to nearly 600 pages, and few would be willing to work

so long for so apparently slight a return. The data upon which he has drawn are voluminous and official in character, but on the whole extremely unsatisfying in content. If the realization of ignorance is the beginning of wisdom in demographic as in other problems, then this work will bear fruit in due season. There are so-called "censuses," the records of births and deaths for one town and a few districts at varied dates (together with laws passed at various times making registration compulsory), demographic sample surveys made by medical officers in the course of their tours (presumably as an additional duty carried out by already overworked people), with some statistical records referring to special and untypical classes of the population, such as labourers building French and German railways, prisoners in the French and British Cameroons, and plantation labourers in the British Cameroons. An additional source of material is the reports to the Permanent Mandates Commission and the discussions which took place in Geneva. Many of the statements made in these reports are due to casual observation or to gossip, and the impression persists that the greater part of the native population and their problems are largely unknown to the administration. Dr. Kuczynski can justly claim that the work reveals "what we actually know about the demographic situation of the West African mandated territories and how the activities of the great Powers have affected mortality and fertility" (p. xviii). We are given considerable insight into the medical and social problems of the areas.

The Cameroons began as a German colony, and after the Great War the area was divided into French and British mandates attached respectively to (French) Equatorial Africa and to Nigeria. Under the German occupation the population apparently did not increase. It was recognized over thirty years ago that the recruitment of labour was a serious problem, as villages tended to send people already sick and therefore a burden on the community. There was a high death-rate on the plantations and also among carriers and those engaged on railway construction. Disease increased during 1914–16 and has continued to provide the French with serious problems among an apparently stationary population. Praiseworthy efforts were made to vanquish epidemics, but they only covered part of the area and vast sources of infection were left untouched. "There is not the slightest chance that the available personnel and resources will be used in the most effective way so long as the most elementary facts [of population distribution] are unknown" (p. 197).

The figures for the British Cameroons are based very largely on estimates and are much less reliable than for Nigeria. In general, little is known of the prevalence of various diseases in the Mandated Territory, and the reports to the League of Nations contain only scanty data on the mortality of the general population. The plantations were bought back by Germans in 1924 and conditions of health there are better than before 1914, owing to changes in recruitment, less strenuous work, better food and drinking water. Nevertheless, 16,000 labourers, scattered over a wide area, were attended by only three physicians, and three of the five Government medical officers were in the ambiguous position of being retained by the plantation companies which it is their duty to supervise. The northern part of the Cameroons is "demographically a *terra incognita*" (p. 352). To judge from the scanty data available about epidemics, mortality appears to be high, but the chances for population growth are perhaps better than in former times, since internal wars and slave raids no longer occur, while the country so far apparently has not suffered essentially from the impact of European civilization. It has been realized that in order to provide adequate health services European doctors must be supplemented by African colleagues, and Kuczynski wisely indicates that Africans

might be employed in the Census enumeration which is the basis of all such public services.

The tale of Togoland, divided twenty years ago into French and British mandated areas, is similar. Under the German administration there was some effort at a detailed study of small areas, but whether "the native population increased or decreased under the German regime it is impossible to tell . . . in some areas at least fertility was low . . . mortality high . . . the natives suffered from the usual diseases prevalent both in Europe and in tropical territories, and succumbed in large numbers to small-pox" (p. 395). In the French mandated area, there is no evidence of crucial change except for "an alarming spread of sleeping sickness" (p. 482). The British area is administered as part of the Gold Coast, but though the programmes of the Censuses were of a comprehensive character they were not carried out fully: in some districts "even the bare enumeration was rendered extremely difficult owing to the wildness of the people" (p. 493). Another problem, common to all such areas, is the understatement of the number of men where it is generally feared that the Census is a preliminary to a head-tax or a hut-tax. There is considerable temporary and permanent immigration into this area, partly owing to the prosperity of the cocoa industry. Tax-evaders and unskilled labourers come from French Togoland, but there is a movement of emigration to the Gold Coast for work on mines and railways and in the Accra sisal plantations. Apparently "the population of the territory has increased since the grant of the Mandate to the British, but whether this was due exclusively or only in part to immigration it is impossible to tell with certainty. There is no indication that fertility is low, nor that mortality is high. It is therefore not unlikely that part of the population increase was due to genuine population growth" (p. 549).

Dr. Kuczynski's volume, issued under the auspices of the Institute of International affairs, is due to a request from Lord Hailey, the Director of the African Research Society, that he should investigate the methods and results of population statistics in some African societies south of the Sahara. The whole range of the work now in progress covers, in addition to the Cameroons and Togoland, the Union of South Africa, the Belgian Congo, French West and Equatorial Africa. It is most earnestly to be hoped that this work will be completed, for it facilitates a fuller understanding of colonial problems, and shows the need for fuller and more reliable information on the distribution of population as an indispensable preliminary to sound economic development, with the provision of adequate health services and the removal of social evils in typical African societies.

T. W. F.

ETHIOPIA: an empire in the making. By FERDINANDO QUARANTA. With a foreword by Lord HAILEY. *London: P. S. King and Son*, 1939. $8\frac{1}{2} \times 5\frac{1}{2}$ *inches;* xx+120 *pages; illustrations and maps.* 7*s* 6*d*

The object of this book is, to quote the publisher, to present an intelligible picture of the social and administrative order established by Italy in her new African dependency. The author is on the staff of the Ufficio Studi of the Ministry of Italian Africa. This department acts as an information bureau on Italian colonial matters, and many of its publications have been outstandingly frank. The author's father was an eminent promoter of Anglo-Italian friendship, and the son knows how to write for the English public.

We are thus presented with a brief résumé of the impressive range of development activities planned and undertaken. Italians are, historically, great road builders, and their first step in any newly acquired territory is invariably the construction of a sound road system. Despite our colonial experience, we have been slow to appreciate the importance of this point.

The possibilities of Italian settlement have been much criticized. We are now told how it is being organized, and the results will be watched with the greatest interest. The capital expenditure involved is of course enormous, and could only be met, for the greater part, by the State. Italy's colonial economic policy is distinctive in this respect; gradual development, mainly left to commercial concerns, is not acceptable: the territory must be made to contribute effectively to the Empire's needs in the least possible time. The preparation of the proposed land register will offer numerous problems of great complexity.

This book does not deal with political matters; but the setting is of course governed by them, and all references to the former regime are coloured by the outworn anti-Ethiopian propaganda. Granted that Ethiopia had only recently begun to advance from the stage of medieval feudalism, it is nevertheless admitted that progress had been remarkable. Banditry and general insecurity were not prevalent to the extent so frequently stated by the Italians. On the contrary markets, in general, thrived, and taxes were largely paid in kind from crops. We also read of former slaves now being made into useful members of the native community. But the domestic slavery, which was gradually being brought to an end, was not oppressive; the slaves were treated as members of the family and frequently rose to positions of responsibility. Similarly, comments on indolence, the uncertainty of Galla and Amhara labour, and the absence of selection in stock breeding and crops are due to lack of experience in dealing with native peoples in the tropics; European standards cannot be applied.

Information on existing conditions is difficult to obtain from sources other than Italian. It seems that resistance is still active away from the communications already established, but that, as these extend in course of time, it will inevitably be crushed. The cooperation of the native population will probably be determined, as elsewhere, by economic necessity. It may well be that, under the enlightened guidance of the present Viceroy, measures of conciliation will remove memories of the conquest and of the subsequent repression, and that pacification and cooperation will thus be hastened.

Vernacular words are not always readily recognizable to the English eye—thus, *chat* for *qat*. In the reviewer's experience, *qat* is more of a drug than the author seems to think; though perhaps its devotees acquire a degree of immunity (see *Geogr. J.*, 93 (1939) 121–2).

One geographical inaccuracy was noticed (p. 88): the river Auasc does not dissolve into the sands, but flows into the lakes of Aussa.

The book is well produced. The maps, though not marking all the places mentioned in the text, are adequate; the illustrations are good; there is a good bibliography, and an index. E. H. M. C.

KENYA CHRONICLES. By Lord CRANWORTH. *London: Macmillan and Co.*, 1939. 9×6 *inches;* xii+368 *pages; illustrations.* 16*s*

Chronicles of the early days of settlement of a new country, if giving first-hand experiences and if they are depicted by a buoyant spirit, must always prove of interest. Doubly are they so to a reviewer who has lived alongside the efforts described in this work and who has watched with the deepest interest the struggle of the early pioneers in Kenya to achieve economic success. The author would be the first to admit however that the ups and downs of the colonist phase of his life, which he so vividly describes, were not quite as serious to him as to many of more limited resources and status. For the majority of those, life was in the early days, and even later on, a grim struggle. A full understanding of this would explain many things for which Kenya settlers

have been condemned, and unfair criticism at home has not helped matters. One of the outstanding features of this book of personal reminiscences is its kindly character.

The chapters on the war in German East Africa, in which the author served for long, are full of interest and constitute a valuable postscript to the tangled history of that campaign. His judgments are on the whole very just. His journey to Abyssinia with Stordy is well described and he has not feared to tell the truth regarding the Abyssinian regime, for in spite of the tears which have been shed about the Amhara, there is no doubt that their system of government could not have been tolerated much longer, and those who expected reform from within would have been disappointed.

His character sketch of that enigmatic figure, Lord Delamere, is full of interest and sympathy, and the capriciousness and instability of his character are frankly stated. Admittedly he had great natural gifts, his power among the colonists was great, and his devotion to Kenya beyond doubt. With different methods of approach and less eccentricity he might however have proved a wiser guide to his followers. Another distinguished character, Frederick Jackson, invited the author's friendship and admiration. He possessed great personal charm and his intimate knowledge of beasts, birds, and insects endeared him to all.

There are a few unintentional errors in the text, but none of great importance. Reference is made to the brave service the coast Arabs rendered during the War under Wavell. This is not quite correct, for Wavell's force was almost entirely composed of wild Arabs from the Hadhramaut, generally known as Shihiri, and they proved to be very difficult to discipline and control. C. W. H.

LIMPOPO JOURNEY. By CAREL BIRKBY. *London: Frederick Muller*, 1939. $8\frac{1}{2} \times 5\frac{1}{2}$ *inches;* xiv+274 *pages; illustrations and endpaper sketch-map.* 12*s* 6*d*

In this volume Mr. Carel Birkby, a young South African journalist, tells us of an excursion he recently made by motor car accompanied by his faithful Zulu boy Joshua Titus from Cape Town to the headwaters of the Limpopo, and thence to where it enters the Indian Ocean some 50 miles north of Delagoa Bay: a remarkable journey to be made in a motor, as nearly all of it was away from the main lines of communications and the travelling must have been exceedingly rough in many places.

Birkby's chief interest is in personalities, in strange peoples and their stories, and he appears to have been very successful in his quest during this long trek. Leaving Cape Town and travelling across the Karroo he crossed the Orange river at Prieska, and passing through Griqualand West and Bechuanaland, he reached the sources of the Limpopo, or Crocodile river, as it is called in its upper course in the Magaliesbergen, a few miles west of Johannesburg; then travelling north he came again on the Limpopo in the little-known Zoutpansberg district, where he spent most of his time visiting the native tribes of that region. Finally he followed the Limpopo across into Portuguese Africa and to the Indian Ocean at Chai Chai.

At Griquatown in Griqualand West Birkby interviewed Maria, the widow of the son of Nicholas Waterboer, the last independent chief of the Griquas, who signed away the Kimberley diamond mine to the British Government for £1000. She is now a pauper and was glad to accept a florin from her visitor. Another interview was with Malaboch, incredibly old and blind, in his early days a terror to the Republican Government of the Transvaal and the last of the native chiefs to defy the white men. His kraal is high up in the Blaauwberg, behind which is the celebrated cave into which the tribe retreated when attacked

by the Boer commando some fifty years ago. Not far off live the Buys Volk, descendants of Conrad de Buys, who was born in 1761 in Cape Colony and was an adventurer and wanderer of a remarkable type. He visited the Transvaal forty years before the voortrekkers and married a sister of Mosilikatse, the Zulu chief of the Matabele. His descendants still live in the Zoutspansberg district, where he acquired a large tract of country. Their obsession is to "go white" by marriage and gradually to eliminate the native blood in their veins.

The book is most readable, full of strange stories told in a somewhat journalistic style but of very considerable interest. Mr. Negley Farson, who met Birkby in Cape Town, contributes an enthusiastic introduction. The volume is illustrated by photographs of varying merit mostly taken by the author during his journey. An outline map, which sufficiently indicates the route he followed, is given on the endpaper. W. L. S.

NORTH AMERICA

NORTH AMERICA. By E. G. ASHTON. (Harrap's New Geographical Series.) *London: George G. Harrap and Co.*, 1939. 8×5 *inches;* 384 *pages; illustrations, sketch-maps, and diagrams.* 8*s* 6*d*

The treatment of the North American continent which Mr. Ashton adopts consists in a reasoned description of nine major regions. In a book of this size there is inevitably compression of material, and when the high lights do not stand out clearly the post-Matriculation student, for whom presumably the book is intended, may fail to see the trees in the monotony of the wood. North America is taken to include "the American Mediterranean," and this is justified by the author on political and economic grounds. Thus we have sandwiched between chapters on the "Mountain and Plateau Lands north of the Great Drought Barrier" and "Northern Canada" a section devoted to the Caribbean and Isthmian lands, ranging from Panama to Trinidad.

The list of works consulted is a curious medley with little bearing on the text, so that one wonders how much of the book represents first-hand knowledge. There is only one American geographer mentioned: Vilhjalmur Stefansson, and the omission of the name of Professor Baulig is to be regretted. Maps are fairly numerous, but many suffer from poor draughtsmanship, over-reduction, or the fact that they are reproductions from the Canadian Year Book. On p. 300 a small, confused map of the eastern United States marks only the Superior region as producing iron ore. A good feature, not common in text-books, is the appreciation of modern economic and social problems which have come to the fore in the last decade, and which have received such publicity under the New Deal. There are short studies of the major regional reclamation schemes associated with the T.V.A., Boulder Dam, and the Grand Coulee, and mention is made of methods advocated by the Soil Conservation Bureau to check erosion, such as strip cropping and the construction of contour ditches. The concluding chapter provides an interesting study of the traffic problems of New York City, with sketches showing recent and projected improvements. Here, as elsewhere, effective use is made of aerial surveys. It is when the author is describing physiographic features that he seems to be on less familiar ground; for example the Ozarks may hardly be dismissed as a "crystalline island in the sedimentary Great Plain," for this description can only be applied to the St. François mountains; nor do the Appalachians trend from "South-West to North-West" (p. 44). The description of the Piedmont "plateau" as "crystalline and unstratified" suggests that it was never folded. Further, the accordance of levels between the main Appalachian ridges and the Cumberland plateau, and

the intersection of peneplaned surfaces in the Piedmont as advocated by Professors Johnson and Fenneman, cannot be reconciled with the description of drainage on p. 252. Spelling mistakes include Lake Meade, and the Uintah range, and the fact that Ouachita and Wichita are variants of the same mountains has been missed. The Erie or New York Barge Canal takes off from Tonawanda, not Buffalo. The map on p. 189 substitutes "the Bad" for "the Black" hills of Dakota. The scenery along the Hudson valley above New York is surely more reminiscent of the Rhine gorge than of a fjord. When these inaccuracies are rectified this will prove a useful text-book. A. F. A. M.

THE ROYAL CANADIAN MOUNTED POLICE. By L. CHARLES DOUTHWAITE. *London: Blackie and Son*, 1939. $8\frac{1}{2} \times 5\frac{1}{2}$ *inches;* x+282 *pages; illustrations and map.* 10*s* 6*d*

This is a popular account of the Royal Canadian Mounted Police, which was founded in 1873 as the North-West Mounted Police to uphold law and order in the territories from which the Hudson's Bay Company had withdrawn its jurisdiction in 1869. At first the Force had to deal largely with Indians, whisky pedlars, and "bad men" in general; later its activities were extended by the Yukon Gold Rush and in post-war years it has been concerned with the drug and illicit liquor traffic and with industrial unrest as well as the day-to-day routine of enforcing federal statutes over half a continent. The author sketches the many activities of the Police, but pays greatest attention to the more dramatic occasions upon which the Mounties "got their man." These accounts read like chapters of a novel and there is little indication of the sources upon which they are based. They might well have been combined with a more detailed description of the organization of this unique Force. The photographs are adequate, but there is no index. T. S. W.

POLAR REGIONS

TWO MEN IN THE ANTARCTIC: an expedition to Graham Land, 1920–22. By THOMAS WYATT BAGSHAWE. With a foreword by FRANK DEBENHAM. *Cambridge: University Press*, 1939. $9 \times 5\frac{1}{2}$ *inches;* xxii+292 *pages; illustrations, sketch-maps, and panoramas.* 15*s*

The book tells of the adventures of the author and Mr. M. C. Lester on the west coast of Graham Land in 1921 and 1922. They had gone south with Wilkins and Cope to explore the east coast of Graham Land, but when the Norwegian whalers on whom they relied for transport could not reach the projected base in Hope Bay, Antarctic Sound, they accepted the alternative offer of a landing near the southern end of the De Gerlache Strait on the west coast. Here the four men spent six weeks before the two leaders, finding all access to the east coast impossible because of the mountains running from north to south, decided to give up the venture and return home with the whalers. Bagshawe and Lester stayed on to make what observations they could, and although their story is a warning to all who might go to such a place without more careful preparation, it is very readable and full of interest.

First there is an account of the early semi-pelagic whaling at Deception Island: the days of the *Svend-Foyn*, *Solstreif*, and *Ronald*, of Bennett and Hamilton. There are one or two small inaccuracies (Deception Island is more than twice as large as the author says, and the main reason for cutting off the tail-flukes before towing a whale is to lessen water-resistance), but the whole is a good and lively first-hand description that should have been published fifteen years ago.

At the base on the west coast of Graham Land, called Hut-Boat Point because

of the old water-boat that formed part of their hut, they worked overtime to make up for lack of equipment, and all their work—meteorology, tides, and animal and bird studies—was severely handicapped by unusually heavy domestic duties. The author describes the weather as trying in the extreme: the cold weather, between +10° and −16° F., proved to be the most bearable, but the temperature could rise or fall as much as 40° with a change of wind, and even in the middle of winter they were not safe from all the unpleasantness of a sudden thaw. Ice conditions were as difficult to summarize as the weather, but the sea-ice was never safe, and there was generally open water to the northward, in the wider parts of the strait.

The notes on animals and birds are of great interest. They saw some twenty elephant seals, mostly males, but no pups. Weddell seals were the most frequent, and crab-eater seals (all gashed or scarred) not so numerous. Sea leopards were seen to be no match for penguins in the water, only the unfortunate birds being caught. The notes on penguins make the hut on the fringe of the rookery seem very real. More information is published in the *Transactions* of the Zoological Society, and all the records are deposited at the Scott Polar Research Institute. G. E. R. D.

PHYSICAL AND BIOLOGICAL GEOGRAPHY

ELEMENTS OF GEOLOGY. With reference to North America. By WILLIAM J. MILLER. 2nd edition. *London: Chapman and Hall, Ltd.*, 1939. 9×6 *inches;* x+524 *pages; illustrations, sketch-maps, and diagrams.* 21*s*

INTRODUCTION TO GEOLOGY. General geology by E. B. BAILEY. Palaeontology by J. WEIR. *London: Macmillan and Co., Ltd.*, 1939. 9×6 *inches;* xii+498 *pages; illustrations and diagrams.* 18*s*

It might be expected that these two books would be very similar: there is little distinction between the titles and a glance at the prefaces reveals a similar origin or intention. The first "is intended to serve as a text for a one-semester course in general geology," the second "originated out of a first year course of lectures . . . at Glasgow University." Except for the fact that in this country both will be of more value to teachers than to learners the resemblance ends there. Professor Miller adds a sub-title "with special reference to North America"; Dr. Bailey might well have added "with special reference to Scotland" or even perhaps to certain parts of Scotland. A text-book based on a continent has the breadth and balance required for a university course; even students of Glasgow will need to use one of the old-established text-books to acquire an adequate knowledge of the geology of the island of Great Britain.

Professor Miller's book is a second edition, revised and better illustrated; the preface to the first edition states that it is an abridged form of the author's 'Introduction to physical geology' (*Geogr. J.* 87 (1936) 373) and 'Introduction to historical geology.' The historical part of the present book is equally praiseworthy; it is prefaced by a brief discussion of geological time and the methods of measuring it; the absence of such discussion of a question, raised by every beginner, was noticed in the review mentioned above; Dr. Bailey also ignores it. The illustrations of fossils, mostly photographs, are excellent and just what the first year or one-semester student requires. The book as a whole will give British professors all the American geology they need even for an honours course.

Geologists will expect from Dr. Bailey something original, stimulating, and unconventional, and in that respect will not be disappointed. Much of Dr. Bailey's accounts of his own work on Highland geology and such structures as

eddies were welcomed by the reviewer for his own information, but would be regarded as post-graduate work; some parts of the book are elementary. The style throughout Dr. Bailey's part is colloquial, sometimes to excess; such a phrase as "ammonites uncoil and die" is obviously liable to misconstruction. Great care is taken to explain even the simplest words derived from classical languages, though no such explanations are given by Dr. Weir in the section on palaeontology, which assumes a considerable knowledge of biology and its technical terms, *e.g.* "amoeboid cells that function as gonads."

The book is divided into seven parts, Dr. Weir being responsible for the palaeontology and Dr. Bailey for the remainder. A more homogeneous book would be produced by omitting some parts. Part III on crystallography is either inadequate or superfluous. The short account of common minerals is necessary for beginners, but would be greatly improved by illustrations of typical specimens such as those given by Professor Miller. It would be far better to refer students to well-tried text-books of palaeontology, graded according to standard, than to include Part VI. The frequent use of old illustrations has not proved altogether satisfactory: for example the figure from Zittel on p. 296, said to be of *Schloenbachia*, is misnamed, and moreover that genus does not occur in the Lower Cretaceous. Fig. 319 has also been copied from Zittel: the specific name is wrong and has also been misspelt. In this instance, as in the case of *Trigonia navis* (Fig. 315) British students would prefer illustrations of species commonly found in their own country. Part VII on the historical geology, is introduced by the naïve statement that the subject is of interest to any intelligent person. It is noticeable that Dr. Bailey's interest evaporates rapidly after the close of Palaeozoic time. Whereas the zones of the Millstone Grits and the Coal Measures are given and the typical fossils illustrated, no zones are given for the Jurassic, which only occupies six pages of text. The solitary ammonite figured happens to be a zone fossil, but is merely given as Jurassic with no hint that it is confined to the Lias, much less to a small part of it. The Cretaceous chapter is even shorter; the statement "the Chalk of England is divided into chalk and flints, chalk with few flints, chalk without flints, chalk marl" is hopelessly inadequate in a book of this size for southern England, and untrue for northern England. The Eocene of England is dismissed in half a page; Rastall and Lake's text-book gives it nine pages, and Watts's 'Geology for beginners' four and a half.

The diagrams and drawings from photographs are nearly all excellent. Almost every part of the book has its value for some reader, though it would be difficult to find any one person to appreciate the whole. The profits from the sale of it have been generously assigned to a geological research fund at Glasgow. C. N. B.

ECONOMIC AND HISTORICAL GEOGRAPHY

EINFÜHRUNG IN DIE ALLGEMEINE WIRTSCHAFTSGEOGRAphie. By ALFRED RÜHL. *Leiden: A. W. Sijthoff*, 1938. 10×6½ *inches; 94 pages; portrait. Fl.2.90*

Alfred Rühl unfortunately did not live to complete this work, now published with a chronological list of his other geographical writings; it is evidently the result of much thought devoted to the aim of economic geography and might then have been improved by the inclusion of examples of economic geography as it should be written. As it is, we may perhaps assume that his own work on 'The localization problem in agricultural geography,' [1] in which he dealt with

[1] 'Das Standortsproblem in der Landwirtschaftsgeographie (Das Neuland Ostaustralien).' *Veröff. Inst. Meeresk. Univ. Berl.*, 1929.

eastern Australia, throws light upon one aspect of his views. The author deplores the almost complete lack of character which in his opinion marks this branch of geography after so many years of effort; and he compares it unfavourably with physical geography. He appears to attribute its backward position and its lack of merit as a branch of science chiefly to inadequate knowledge of economic and social science on the part of those who have contributed to it. Much of the text is occupied in showing what economic geography is not. In this we cannot follow him here, but the kernel of his beliefs may be summarized as well worthy of consideration.

Rühl regards economic geography as "that part of economic science, and so of social science, which is concerned with economic forms in their regional variety" or alternatively as the "differential localization of economy," with a very wide significance given to "localization." He emphasizes however that these are not hard and fast definitions. He examines the theoretical character of economic geography under three headings: (*a*) general and (*b*) special, which may be compared respectively to ethnology and ethnography, the latter being concerned with developments in various parts of the world; and (*c*) "regional economic geography." This last is descriptive and provides, or ought to provide, materials for (*a*).

General economic geography is concerned with phenomena like irrigation or a product like wheat, iron ore, or the distribution of agricultural tractors. This aim he compares to the function of physical geography in studying, say, glaciers, and he notes that economic geographers have in fact pursued this aim to quite a considerable extent. But he has to point out that physical geography goes much farther, for it studies many individual examples of a phenomenon (*e.g.* glaciers) with the aim of discovering the very nature and qualities of glaciers in general. This stage, he contends, has not been reached in economic geography. This theoretical aspect of general economic geography to which he directs attention would aim at discovering general rules for the distribution of products. The single products would not be placed in the foreground but would serve as examples in the formulation of concepts. Herein lies the link with "regional economic geography," since only with the help of the concepts due to general economic geography is it possible to attain a theoretical grasp of the single objects described in regional studies. A. G. O.

KOLONIALE GESTALTUNG: Methoden und Probleme überseeischer Ausdehnung. By RICHARD THURNWALD. *Hamburg: Hoffmann und Campe*, 1939. $8\frac{1}{2} \times 5\frac{1}{2}$ *inches; 492 pages; illustrations. M.*9.80

This book consists of two sections, a series of commentaries on the colonial history of European Powers, and a close examination of modern colonial problems, particularly in Africa. The first has been included no doubt to make the work a comprehensive study of colonial development, but it has little real connection with the second part. With due allowance for the avowed object of the writer, to convince his German readers of the value of colonies, and to set out a reasoned plan for the administration of future German colonies, it is worth attention, and in present circumstances must be considered moderate in tone. There are occasional rather biased historical passages, and an underlying theme that the record of German colonization is no worse than that of other countries. The plan for future colonial administration is worked out in detail. It is interesting to note that a continuance of a barter, rather than a gold, basis for trade is assumed; that economic development would be strictly in the interests of the home country; that rigid segregation and control of movement would be imposed on the native populations, and that a form of indirect rule,

with training in handicrafts, in place of western education, is recommended. The author shows a close acquaintance with current literature, and makes much use of Lord Hailey's 'African survey.' G. R. C.

DE TWEEDE SCHIPVAART DER NEDERLANDERS NAAR OOST-Indië onder Jacob Cornelisz. van Neck en Wybrant Warwijck, 1598–1600. Edited by J. KEUNING. I. Voorgeschiedenis en uitreeding . . . (Werken uitgegeven door de Linschoten-Vereeniging. XLII.) *'s-Gravenhage: Martinus Nijhoff*, 1938. 10×6½ *inches;* cxiv+184 *pages; illustrations and facsimile maps*

The present volume deals with the second expedition that sailed from Amsterdam for the East, four years before the formation of the East India Company: an expedition of special importance because it was the first to reach the Moluccas, whence enormous wealth was destined to pour into the Netherlands in the form of mace, nutmegs, and cloves. The previous voyage had not been very successful, but it had revealed the weakness of the Portuguese. No fewer than eighty ships were sent out in the year after its return (1598) by various groups of speculators, to the East and West Indies, Brazil, Guinea, and elsewhere.

The second expedition consisted of eight ships; six were large cargo carriers, and two fast-sailing yachts which acted as scouts. Though separated by wind and weather on the way, some calling at Madagascar and some at Mauritius, the whole fleet arrived at Bantam. Four loaded cargoes there, returning to Holland under van Neck; while the rest, under Warwijck, continued their voyage. They called at Jacatra (now Batavia), Toeban, and Jaratan (near Grissee, East Java), and then at Arosbaja on the north coast of Madura, where the natives, having unpleasant memories of their treatment at the hands of the previous expedition under Houtman, were far from friendly. From here they went on to Hitoe (Amboyna), and thence two of the ships sailed for the Banda group, where trading posts were established at Lontor and Banda Neira. The other two, failing to get cargoes at Amboyna, went on to load cloves at Ternate and sailed for home, leaving five men behind them to establish trade.

The genius of the expedition was Plancius, who had invested in it not only his brains but a considerable sum of money. The fleet formed a community ruled over by the Admiral, who had full powers of life or death. Each ship had its "College of Justice," wherein the *Koopman*, or head salesman, acted as magistrate, taking rank above the captain. The religious side of the expedition was entrusted to "Comforters of the Sick" (*Ziekentrooster*). Plancius and others made efforts to have proper spiritual advisers added to the ships' companies, suggesting that some of the theological students educated at public expense might serve in this capacity. Three were appointed, but were unwilling to exchange the joys of student life for the rigours of seafaring, and the scheme fell through. The crews however had to "listen reverently to God's word" or be fined. The commissariat was good, on paper. Each man received 3 litres of beer, 1½ litres of wine, and a ration of brandy per week; and ½ lb. of butter. In practice, butter gave out after three months and was replaced by an issue of oil. The beer vat was soon empty, but more serious was the failure of the water-supply. Dysentery and scurvy raged, and relief was only afforded by oranges obtained from a chance-met home-coming ship.

Van Neck's journal, printed verbatim from his original MS. (in old Dutch), abounds in vivid descriptions. Unlike so many other Dutch admirals, van Neck's dealings with the natives were always honourable. He arrived at Bantam soon after the departure of the previous expedition, and, learning that its members had behaved "with great cruelty and insolence," discussed with his

officers "how with the greatest courtesy we could win the friendship of these proud Javanese." The fleet's credentials were presented with all due ceremony, "wrapped in red velvet," and received by the Prince's representative on a golden salver. The popular belief that the Javanese were savages should be dispelled by van Neck's account of his reception. The description of "a great gathering of people on the *aloon-aloon* under a huge, wide-spreading tree . . . that so shadowed the whole place that no ray of sunshine could penetrate" would apply equally well to-day; it was evidently one of the great *waringen* that spread their immense branches over the central meeting-place and market of every Javanese town.

The book is admirably annotated, and its references and bibliography offer a wide field to the student of East Indian exploration. The illustrations include some interesting old prints, and a fine picture of van Neck's triumphant return to Amsterdam in 1599. H. W. P.

A "CRÔNICA DOS FEITOS DE GUINEE" DE GOMES EANES DE Zurara e o manuscrito Cortez-d'Estrées. By ALVARO JULIO DA COSTA PIMPÃO. *Lisboa: Casa do Livro*, 1939. $9^{1}/_{2} \times 7$ *inches; 92 pages.* [9s]

For half a century at least scholars have noted contradictory statements in the text of the Paris MS. of Zurara's 'Chronicle of Guinea.' Among others, Dr. Jaime Cortesão and Dr. Duarte Leite have sought to explain these and other defects, but a fuller examination has been made by Professor Pimpão in 'A Cronica de Guiné' (Coimbra, 1926) and continued in the present work.

The importance of the Chronicle comes from the fact that it is the only contemporary account of the early Portuguese exploring, crusading, and commercial expeditions down the west coast of Africa, and the period it covers ends in 1448. The Chronicle minutely relates the first phase of that exploration which led to the discovery of the Cape route to the East and it is based on a work (now lost) by one Afonso Cerveira, who was factor at Benin. There are four MSS. (not counting modern copies) and, strange to say, all of them in libraries outside Portugal; the two important ones are the Paris Codex containing the portrait of Prince Henry similar to that in the triptych of Nuno Gonçalves and the abbreviated copy of Valentim Fernandes, dated 1506, at Munich. The former was printed in 1841 and served for the Hakluyt translation. It is thought to be the origin of the others, and while no question arises as to the authenticity of the narrative as a whole, there are many problems which Professor Pimpão has endeavoured to solve. One of these is that while the MS. is declared to have been presented to King Afonso V in 1453, it contains references to posterior events such as Henry's death (1460), though in another passage he is said to be still alive and a little less than sixty years of age. The text therefore cannot be the original one.

The present title of the Chronicle is only about a century old, and when Zurara refers to it in his other works he calls it the 'Feitos de Guiné.' Professor Pimpão criticizes the modern title on the ground that the Chronicle deals very much more with conquest than discovery, and he finds that the chapters on the former subject have been considerably abbreviated in the Valentim Fernandes copy. It is true that the Chronicle was meant to describe the notable deeds in the conquest of Guinea, or, as its author says in the letter preceding it, to be a book of Henry's achievements, but it may be argued that there is no necessary contradiction between these objects. Like the expression Guinea, the Prince's deeds may be taken in a wide sense and include those of his Captains, yet it is puzzling to find misstatements in his regard, while other acts of his busy life about which the King ordered Zurara to obtain full information are confined to

one or two chapters. After analysing the Paris MS., comparing passages of it with others from the copy of Valentim Fernandes and quoting from the 'Asia' of Barros and the 'Historia de las Indias' of Las Casas, Professor Pimpão suggests that the Chronicle of Guinea, as we have it, consists of chapters from two distinct works, a biography of Prince Henry and a book on the 'Feitos de Guiné,' which were pieced together and altered, after Zurara's death, by an official of the Royal Archives. The Paris MS. would then be one of the series of beautifully illuminated codices produced in the reign of King Manuel I. Professor Pimpão offers this as a hypothesis and all he claims to have proved is that Zurara's work has been "vitiated." While there can be no doubt of this, his hypothesis raises various difficulties, such as the disappearance of the two works out of which the Chronicle is thought to have been constituted, and notwithstanding his praiseworthy efforts and the important new data he has brought forward, the mystery remains and it will probably never be solved, unless by some casual discovery in the Torre do Tombo.

We do not know how the Paris MS. came to leave Portugal, but Barros could find no complete copy and had to use disjointed material from torn papers, notwithstanding which he followed Zurara's narrative fairly closely. E. P.

DIE NEUGESTALTUNG DER DEUTSCHEN GEOGRAPHIE IM 18. Jahrhundert. By ARTHUR KÜHN. (Quellen u. Forschungen zur Geschichte der Geographie u. Völkerkunde. Band 5.) *Leipzig: K. F. Koehler*, 1939. 9×6 *inches;* viii+150 *pages; illustrations and facsimile map. M.*12 (*unbound M.*10)

The development of geography in Germany during the eighteenth century is presented in a clear, methodical, and interesting way, and is a fitting commemoration of the two-hundredth anniversary of the death of Georg II August, patron and benefactor of Göttingen University. The history of geographical thought in Germany during that century is very little more than the history of work done at Göttingen. Here between 1700 and 1800 geography flourished as it had never flourished before in Europe, and three great men stand out from lesser but not unimportant men—Franz, Büsching, and Gatterer. Without these philosophers, Humboldt and Ritter would probably have remained unknown, for their greatness is due to the fact that they "stood on the shoulders of the Göttingen men." Franz, Büsching, and Gatterer were not only great philosophers but also great teachers who fired the whole city with their genius. From a hotchpotch of ideas and facts they evolved the scheme for correlating landscape features with human life. They discarded the older ideas of mathematical and physical geography and emphasized the human and historical aspect. This book should be given a prominent place among our source books on the history of geographical philosophy. It is scholarly, complete in every detail, and the lives and activities of the pioneers of modern geography make interesting reading. N. V. S.

EARLY SCIENCE IN OXFORD. By R. T. GUNTHER. Vol. XI. Oxford Colleges and their Men of Science. *Oxford: Printed for the author*, 1937. $8\frac{1}{2}\times5\frac{1}{2}$ *inches;* xvi+429 *pages; illustrations and map.* 30*s*

This eleventh volume of Dr. Gunther's 'Early science in Oxford,' although part of the series, is complete in itself, and as it brings the story down to the present time is somewhat outside the general scope of the rest. It treats of the services to science of Oxford men from the time when the city first came to the fore as an intellectual centre, its main content being a chronological summary of the work of individual members of each college taken in turn. It will of course

appeal primarily to Oxford men, but is of interest to all concerned with the history of science in general.

As geography has only in recent times been accepted as a science, the bearing of the book on geographical progress is but incidental, and among the many brilliant names mentioned those whose work touched the subject were concerned more especially with the mathematical side. Such were Leonard Digges, Edmund Gunter, and Edmund Halley. There is the outstanding figure however of Sir Joseph Banks, whose services to geography were more extensive and varied, and a few find a place who became chiefly noted for foreign travel, such as Thomas Hariot, of Virginia fame, Sir Anthony Shirley, and the orientalist Edward Pocock (Bishop Richard Pococke does not seem to be mentioned). James Howell, besides describing his own continental tours, was author of one of the early guides to foreign travel (1642), a later writer in the same line being Edward Leigh. Both were anticipated by the Elizabethan writer Philip Jones (1589). On the strictly scientific side a noted figure from our own times is H. N. Moseley of the *Challenger*, and geology is well represented by such names as Lyell and Buckland. Had not the view been focused on science, many more Oxford men would have found a place, and in view of the special outlook adopted one would hardly have thought to find such names as R. D. Blackmore and Lewis Carroll, though the latter lectured on Mathematics. When such names are included one might have expected some mention of a noted early geographer, Nathaniel Carpenter. But the task of selection cannot have been easy.

There is a good deal of interest also to the general reader, for instance the account of the first growing of the "Blenheim Orange" apple by George Kempster. In some places a few more finishing touches would have improved the book. We are not told the source of the quotation on the apple grown by Kempster, nor the recipient of the letter of which an extract is given on p. 215. There are many reproductions of portraits, some of them humorous sketches, but the authorship is rarely stated. There is a list of portraits at the beginning, but not of the other illustrations, and the list given includes one or two that are not portraits. But in view of the amount of untiring labour given to the preparation of the volume it would be ungracious to cavil at such slight blemishes. There are several appendices on special subjects, and a somewhat fanciful map illustrating the scientific associations of the colleges and other buildings.

E. H.

GENERAL

EPICS OF THE XXTH CENTURY. Great Flights. By E. COLSTON SHEPHERD. *London: Adam and Charles Black*, 1939. $8\frac{1}{2} \times 5\frac{1}{2}$ *inches;* viii + 232 *pages; illustrations. 7s 6d*

Mr. Colston Shepherd has written a very readable account of some of the most famous post-war flights, beginning with Captain Ross Smith in 1919, and ending with the disaster to Miss Earhart in 1937. The chapter on Wilkins' crossing to Spitsbergen in 1928 illustrates the use of the aeroplane in exploration; the other chapters are in the main accounts of courage and endurance in pioneering routes to-day in regular commercial use. They are told without prejudice and enlivened by the writer's reminiscences of the pilots themselves. Reference to Russian achievements is limited to a few incidental lines on the drift of the Soviet Polar Camp in 1937; the flight of Gromoff and his companions from Moscow to California over the North Pole entitled him to mention along with Kingsford Smith, Wiley Post, the Marquis de Pinedo, and others.

THE MONTHLY RECORD

THE POLAR MEDAL

His Majesty the King has been pleased to present the Polar Medal in Silver to Mr. Colin Bertram, Mr. V. D. Carse, Mr. N. A. L. Gurney, the Reverend Launcelot Fleming, Mr. J. H. Martin, Captain I. F. Meiklejohn, Mr. H. M. Millett, Mr. J. I. Moore, Mr. Brian Roberts, Lieutenant-Commander R. E. D. Ryder, R.N., and Captain L. C. D. Ryder, members of the British Graham Land Expedition, 1935–37; and the silver clasp to Surgeon-Commander E. W. Bingham, R.N., Mr. W. E. Hampton, Mr. Quintin Riley, Mr. J. R. Rymill, and Mr. Alfred Stephenson, of the same expedition, who had already received the Polar Medal for their work with the British Arctic Air Route Expedition of 1930–31.

PRIZE FOR GEOGRAPHICAL ESSAY

The prize offered by the Council for a Geographical Essay has been awarded to Mr. S. Swallow, of St. Catharine's College, Cambridge, and his essay will be published in the *Journal*. The Council have resolved that a money prize be not offered for competition at the end of 1940 or until further notice, but that University students who would have been eligible to compete had the prize been offered, that is to say, registered Internal or External Students reading for Honours in Geography during the calendar year 1940, are invited to submit during the month of December 1940 essays not exceeding 5000 words, from which a selected essay will be published if of sufficiently high standard. The essay should be either a critical survey of recent additions to knowledge in a limited geographical field selected by the writer which may or may not include field work or research carried out by the candidate, or a discussion of some current problem in its geographical aspects.

THE PORT OF ANTWERP

In an article contributed to the *Bulletin* of the Belgian Society of Geographical Studies (December 1938 and June 1939), Fr. J. Deprez gives a detailed study of the port of Antwerp, and an analysis of its traffic and zones of influence, which is of interest as a statement of the position before the present situation arose. The advantages of Antwerp as a great port are due as much to enlightened policy as to geographical conditions. Its railway communications with the great industrial region of Western Europe are superior to those by water; its traffic is in part due to its development as an industrial centre, manufacturing both for export and re-export, and favoured by the increasing concentration of Belgian industry in the quadrangle Antwerp–Brussels–Liége–Maaseyck; its administration and financial facilities make it a centre of world commerce, particularly in the grain, wool, and cotton markets. The balance between imports and exports is well maintained, and the Belgian share in them is a feature of strength (55 per cent. of the exports, 70 per cent. of imports). Half of the import trade of the Belgian Congo originates at Antwerp, and three-quarters of the exports are directed thither. A prominent feature of Antwerp's exports are metallurgical products which in 1936 exceeded the total exports of these through all French ports.

If the national industrial region and the Congo trade form the stable foundation of Antwerp's trade, relations with the West European zone fluctuate, sometimes very rapidly, and require the close attention of the authorities. Though the geographical conditions are on the whole favourable, the traffic is exposed to political and economic policies of neighbouring states. Antwerp has

good rail communications with the industrial regions of north and north-eastern France, but meets here the competition of Dunkerque. Arrangements were recently made by which Dunkerque was to handle an additional half-million tons of this traffic, Belgium receiving certain fiscal compensations. With Germany the struggle was more complicated and severe. The German railways and ports, especially Hamburg, were fighting both distance and the Rhine riverine ports, and ultimately Antwerp's rail traffic. Concessions on the railways reduced the freight charges per ton-km. as the distance increased (*e.g* the distance Munich–Hamburg, 810 kilometres, was reduced to a distance equivalent to 522 kilometres, a figure shorter than the distance to Antwerp), and additional concessions were made for goods proceeding to a port. This competition was felt at a distance of 50 kilometres from the Rhine, and was irresistible at 100 kilometres. Rail traffic between Belgium and Germany, 2·2 million tons in 1913, fell to 0·97 million tons by 1929, and declined further. Thus the right bank of the Rhine was cut out of Antwerp's zone of influence, and the left bank area severely diminished, the metallurgical output of the Saar, for instance, being exported *via* Ludwigshafen, and Antwerp maintaining a foothold in the Aachen district only. A similar struggle lasted for some time over the Swiss traffic, until a parity agreement was reached.

As there is no effective canal communication with northern France, no problems have arisen, but Holland, and particularly Rotterdam, enters into the competition for water-borne traffic. By an extensive building of canals and the training of the Maas, the traffic of the growing Limburg industrial region was secured for Rotterdam, and the Juliana Canal also threatened to tap the Liége region.[1] This was countered by the building of the Albert Canal, which also links the Campine coal area with Antwerp and Liége. In Germany the strongest competition comes from the port of Emden: here minerals from Scandinavia and coal from the Ruhr form the principal traffic (imports, 1936, 3·6 million tons, of which 93 per cent. were minerals; exports, 4·2 million tons, coal 84 per cent.). The projected Hansa Canal would further strengthen this hold, reducing the distance from the Ruhr to Bremen to 295 kilometres, compared with the 386 kilometres to Antwerp. Despite all this activity, the Rhine holds its position as a natural waterway. In 1929, 30 million tons passed downstream to Antwerp and Rotterdam, and 24 million tons ascended the river. In this traffic the share of Antwerp has slightly increased since 1929, due to Franco-Belgian agreements and the Belgian monopoly in the transport of potash. Nevertheless the total Rhine transit traffic of Antwerp in 1936 amounted to 6·3 million tons only (4·3 in 1932), while Rotterdam handled 25·5 million tons (15·2 in 1932).

THE NORDVIK-KHATANGA REGION

A collection of articles on the geological investigation of the Nordvik–Khatanga region and the Taimir peninsula has been published by the *Glavsemorput* ("Principal northern sea route," Leningrad, 1939. 12 roubles or 22*s* 6*d*). The work was done in 1933–36, and the articles describe the newly-discovered economic deposits of the region. Several salt domes with associated gypsum, sulphur, and oil are described. The cores of these domes are probably of Devonian age, but the oil is principally concentrated in the deposits of the Lower Jurassic age. There is in this region also some coal of Cretaceous age. The economic value of these deposits is not definitely ascertained as yet.

The publication is in Russian and no summary in English has been provided.

S. I. T.

[1] See F. Dussart: "L'aménagement de la Meuse néerlandaise," in 'Liége, la Meuse et le bassin Mosan' (Assoc. franç. pour l'avancement des sciences, 1939).

DISTRIBUTION OF AURORAL FREQUENCY IN THE ANTARCTIC

In *Terrestrial Magnetism and Atmospheric Electricity* for December 1939, Messrs. F. W. G. White and M. Geddes contribute a paper on the "Antarctic zone of maximum auroral frequency" based on a general discussion of data derived from the various Antarctic expeditions. The data so far collected suffice for the determination of the approximate position of the zone of maximum auroral frequency which, as shown on an accompanying sketch-map, takes the form of a circular belt, having a radius about 18°, centred about a point at 75° S., 129° E. This centre is near the magnetic axis pole, not the magnetic pole, which however lies well inside the belt. The belt appears to pass through the geographic pole, though further data are needed to confirm this, and Little America lies just inside it. The western sector of the Antarctic comprising the Weddell Sea area lies far outside the circle, which accounts for the fact long known that very few aurorae have been observed there in comparison with the eastern sector about the Ross Sea. The zone of maximum auroral frequency in the Antarctic is more nearly circular than in the Arctic, in conformity with a more symmetrical magnetic field.

A NEW MAP SERVICE

The 'Serial Map Service' established by the Phoenix Book Company (annual subscription 17*s* 6*d* post free, including binder) is designed to help the general reader to appreciate the geographical and historical background of the war and of international politics. The monthly parts consist of four or five maps, produced by Messrs. George Philip, with accompanying commentaries. The four parts already published deal with a variety of topical issues, including the economic geography of the Baltic countries and Germany, the climate of Finland, the historical geography of the Balkans and Poland, and the political situation in India and the United States. The sheets, measuring approximately $11\frac{1}{2} \times 9$ inches, are printed in two or more colours; being drawn from varied sources the maps are not uniform in style, and some are rather crowded with detail, but most of them make their point clearly. The scheme is clearly capable of considerable expansion, when the initial difficulties have been overcome. To those who have not easy access to standard geographical and historical atlases the service should prove very useful.

BIBLIOGRAPHIES OF MAPS

The first section of Walter Thiele's 'Official map publications' (Chicago, American Library Association, 1938) is a compressed history of cartographical development, with extensive bibliographical reference. Particular attention is given to the maps of the North American continent. The second part, 'Contemporary government maps and mapping services,' is useful for its analysis of the functions of the various mapping authorities in the United States (four primary and thirteen secondary agencies: the Science Advisory Board in 1934 recommended the consolidation of the greater part of the primary agencies). A reference list of maps published by the United States government, with notes on sources of information on current issues, will be helpful to students. Canada, Latin America, Great Britain, Germany, and four other European countries are included, France and Italy being among those omitted. In several instances the information is not always complete: no mention is made under Bolivia of the 1/M map in four sheets, or the thirty-five sheets of the 1/250,000 map; some sheets of Ecuador have also been published on the scale of 1/20,000 and 1/25,000, and three sheets of Argentina in the 1/M International Map. The map of Hispanic America (1/M) published by the American Geographical

Society is not yet complete. The German 'Übersichtskarte,' 1/800,000, is stated to be the only medium small-scale map of Europe and Asia Minor available, overlooking the War Office 1/M map of Europe and the Near East.

A useful list of historical atlases for school use has been compiled by Professor R. F. Treharne for the Historical Association (Pamphlet No. 114, G. Bell and Sons, 1939, 1*s*). Brief critical notes indicate the scope and standard of the atlases, British and foreign. More elaborate cooperative works, such as the 'Geschiedkundige Atlas van Nederland,' are not included, as the compiler will deal with them elsewhere.

RECENT BIBLIOGRAPHIES

The volume of the Bibliographie Géographique Internationale for 1938 has now been published, and will be distributed by the Society to subscribers in the British Isles and Dominions shortly. The terms upon which the distribution is undertaken by the Society have frequently been explained in the *Journal* (*cf.* 85 (1935) 109). The price of the current volume is 9*s* 6*d*, post free, from the Office of the Society.

Supplement No. 63, 'Recent Geographical Literature, Maps, and Photographs,' listing additions to the Society's collections mostly in the second half of last year, will be distributed shortly to Fellows who have signified their desire to receive it.

We have received from Mr. Trevor Lloyd a bibliography of text-books and reference books on geography, prepared for the School of Geography at Clark University. It includes sections on American and British school books, texts and reference works of university standard, and books for adult education. The lists appear to be comprehensive, although it is not always clear how particular books have been allotted.

Mr. E. E. Edwards, of the Bureau of Agricultural Economics, has presented three bibliographies compiled by him and issued among the 'Bibliographical Contributions' of the Library of the U.S. Deptartment of Agriculture. 'Selected references on the history of English agriculture' contains thirty-one references to other sources of information, fourteen on geography and environment, and sixty-seven on history. The contents of books are given in much detail, with extracts from reviews. References are to modern works only: for contemporary accounts use must be made of the other bibliographies cited, which include several by Mr. G. E. Fussell (*cf. Geogr. J.* 74 (1929) 170). The other lists deal with the significance of the frontier in American history, mainly concerned with Professor F. J. Turner's thesis that American institutions have adapted themselves to a developing people, and with American colonial agriculture, taking account of the contributions of European peoples. The lists have been carefully compiled, and all are of interest to the geographer.

OBITUARY

VICE-ADMIRAL SIR PERCY DOUGLAS, K.C.B., C.M.G.

Born on 1 November 1876, Sir Percy Douglas was the second son of Admiral Sholto Douglas, C.B. He was educated at Eastman's, Southsea, and joined H.M.S. *Britannia* as a naval cadet in 1890, going to sea as a Midshipman two years later in H.M.S. *Cleopatra*. The *Cleopatra's* commission was on the North America and West Indies Station, and it was while serving in this ship that Douglas saw his first active service, being landed with detachments of seamen and marines for the protection of the inhabitants of Bluefields in Nicaragua. By a curious chance his last sea service was on the same station when he commanded H.M.S. *Ormonde* some thirty years later.

In March 1896 he was promoted to Sub-Lieutenant, and a year later took up his first surveying appointment in H.M.S. *Stork*. Promoted to Lieutenant in 1898, he had by then engaged in surveys in Mauritius, the Red Sea, and the Mediterranean; in 1899 he was appointed to the *Research* in home waters, where he served under Captains W. U. Moore and A. M. Field, proceeding abroad once more as First-Lieutenant of the *Rambler*, and serving for three years in the Red Sea and on the China Station. Douglas's advancement as a surveyor had been unusually rapid, and it was only five years after the commencement of his surveying career that he was made a First-Class Assistant Surveyor; moreover he learned his job in a hard school. Another year in the *Research* at home was followed by a similar period as First-Lieutenant of the *Goldfinch* on the West Coast of Africa, and here his health suffered to such an extent that he had to relinquish the idea of a further spell of duty on the China Station, and remained at home in 1907 working at the Admiralty until appointed to the *Egeria* in British Columbia. His good service in the *Egeria* and previously was responsible for his selection for the command of H.M.S. *Waterwitch* on the China Station, and he assumed charge of the surveys in the Malacca Straits in 1908. Two-year commissions were then the normal thing, and in March 1910 Lieut.-Commander Douglas, as he then was, was appointed to the Hydrographic Department as Superintendent of Charts, a post which he held for very nearly five years; he was promoted Commander in December 1910.

The war with Germany which started in 1914 found the Hydrographic Department well organized for expansion. Much of this was due to the foresight and initiative of Commander Douglas, and it was very obvious that, when the Vice-Admiral in the Mediterranean asked for the appointment of a surveyor on his staff, Commander Douglas was selected and sent out to the Eastern Mediterranean. After carrying out reconnaissance surveys in the approach to the Dardanelles, he was present at the landing at Helles and other places on the peninsula, and in due course as the hydrographic work increased, a surveying ship was sent out from England to act under his orders, which included the production and printing of local charts and Notices to Mariners. The problems connected with indirect bombardment, minefields, ranges, makeshift lighting, and the sinking of merchant vessels to form breakwaters, were all a part of his duty, and his zeal and ability were recognized by promotion to Captain in December 1915. After the evacuation of the Dardanelles peninsula Douglas returned to England, and in April 1917 was appointed the first Director of the newly formed Naval Meteorological Service, a post which he held until January 1918, when he joined the staff of the Vice-Admiral at Dover, and participated in the celebrated operations against Zeebrugge and Ostend. His

valuable services in this connection were rewarded by the C.M.G. and the Belgian Order of Leopold.

Shortly after the end of the war Douglas was appointed Assistant Hydrographer, and in July 1921 he took command of H.M.S. *Mutine*, later transferring to H.M.S. *Ormonde* in charge of surveys in British Guiana and the West Indies. He returned to England in September 1924 and was appointed Hydrographer of the Navy on October 1 of the same year. The normal period of service as Hydrographer was extended for three years, so that Admiral Douglas occupied the post for eight years in all; he was promoted to Rear-Admiral in February 1927 and was placed on the Retired List at his own request in October 1929, being promoted to Vice-Admiral on the Retired List in June 1931. His services were recognized by the C.B. in 1929, followed by the K.C.B. in 1933.

During the period of his service as Hydrographer of the Navy Sir Percy Douglas did much to develop survey instruments such as the 45° Prismatic Astrolabe, and to perfect echo-sounding apparatus, in which he was a firm believer; it is largely due to him that the Admiralty Echo Sounding Gear was adopted for general use. He interested himself in a number of ways outside the ordinary work of the Hydrographer and was a member of numerous committees, mainly of a technical nature. He was elected to the Council of this Society in 1933, and in 1938 became a Vice-President.

Admiral Douglas became a member of the *Discovery* Committee early in 1928, his arrival coinciding with preliminary discussions as to the advisability of replacing the old *Discovery*. Douglas was Chairman of the Ship Sub-committee, and in May that same year suggestions were made to build a new steel ship, specially designed for oceanographical work in Antarctic seas, to take the place of the wooden *Discovery*, an auxiliary sailing ship, which had proved too heavy and cumbersome for the work. The building of the new ship was authorized late in January 1929, and within ten months she was launched completely ready for sea. Douglas therefore from the start played a decisive part in the history of *Discovery II*, and was in charge when after ten years of voyaging she was finally laid up in June 1939, the most travelled by then of all Antarctic ships. He was much the most active of the Committee members in its ship affairs, including the choice of ship personnel, in which he was most successful. When the ship was in commission there was little to do, but every two years she returned to St. Katherine's Dock for a refit, and Douglas was immediately on the spot to take charge, and the success of the work at sea must be in large part attributed to his high standards of fitness and to the routine supervision which, in collaboration with the Crown Agents, he put into the work at home.

Through the Committee's work Douglas soon became interested in Antarctic affairs generally, and as Hydrographer he produced the first issue of the Antarctic Pilot in 1930. His last Antarctic services were to Rymill's Graham Land expedition in 1934–37, when he accepted chairmanship of an advisory committee, which was of the greatest help to the expedition. Douglas's peculiarity however was to do things as unobtrusively as possible, but if he once accepted responsibility he was prepared to go to any trouble in carrying out his duty, though always as if anxious to remain in the background. One had to know him intimately to discover this peculiarity, and how once being in he did not spare himself till the work was done.

On his retirement from the post of Hydrographer in 1932, he was appointed Acting Conservator of the Mersey and Chairman of the Dover Harbour Board; the latter post was one which interested him very greatly on account of his wartime association with the port, and on the outbreak of the present war with Germany he was appointed Commodore Superintendent of Dover, a post for

which he was admirably suited. It was whilst holding this appointment that he died, and in accordance with his known wishes he was buried at sea in the Straits of Dover on 7 November 1939. J. A. E.
J. M. W.

MEETINGS: SESSION 1939–40.

Thirteenth Meeting, 4 March 1940. The President in the Chair

Elections: Anton Bon; Mrs. E. Nancy Kershaw, F.S.A.SCOT., J.P.

Paper: Karakoram, 1939. By Mr. Eric Shipton. Read by Dr. R. Scott Russell

Fourteenth Meeting, 11 March 1940. Mr. Leonard Brooks, Vice-President, in the Chair

Paper: Past sea levels at Dungeness. By Mr. W. V. Lewis

Fifteenth Meeting, 18 March 1940. The President in the Chair

Elections: Richard Mark Cooper, B.A.; Edward José Dunne; Reginald Edward Greenway, M.A.; Harold Percival Brindley Hoare; Walter Eric Johnson; Edgar Priestley Leach; John Sharman Ruddock; S. Durai Raja Singam; A. P. Sinha; Clarke Edward Leighton Thomson; E. E. Wells, C.E., M.A.

Paper: The search for economic plants. By Sir Arthur Hill

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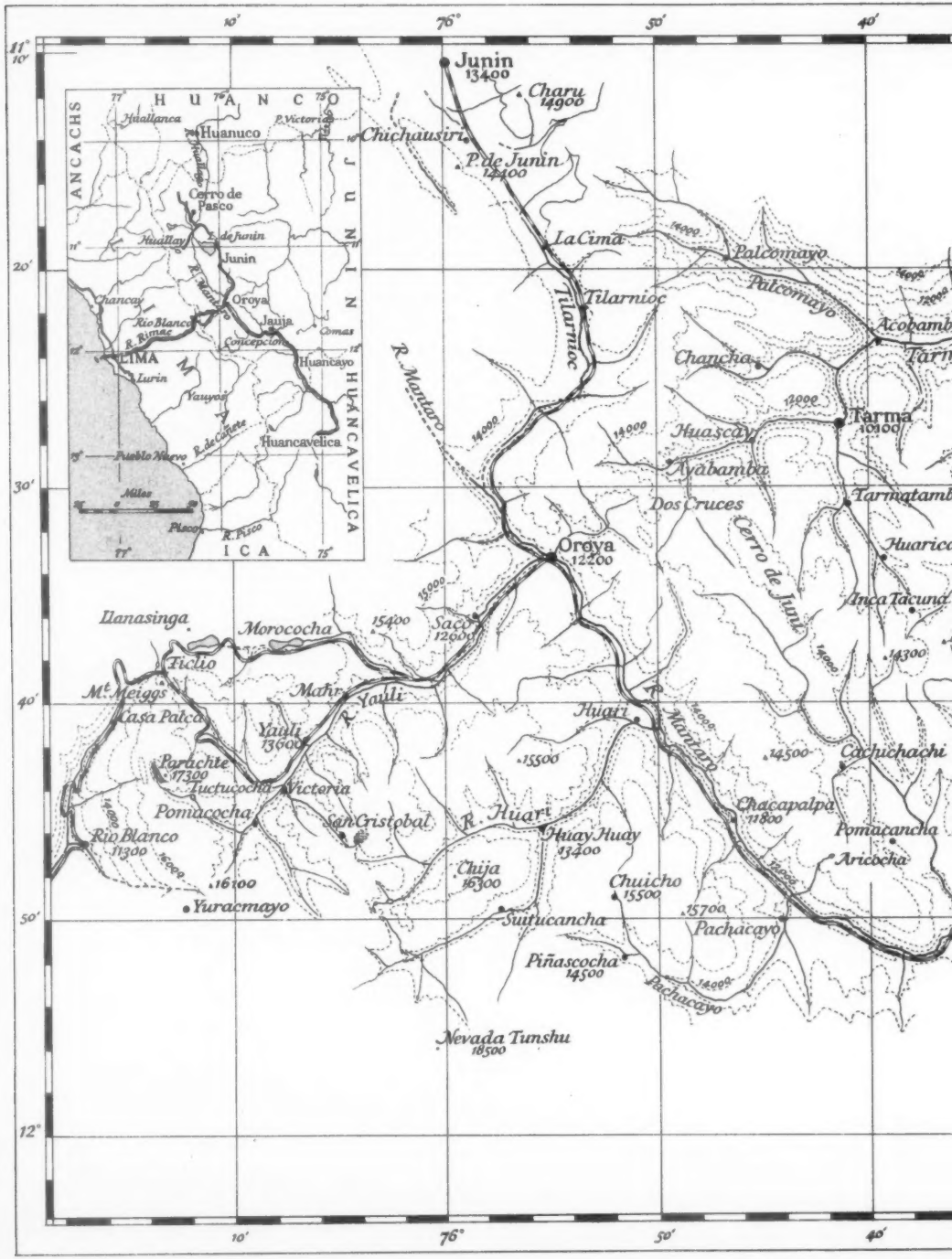

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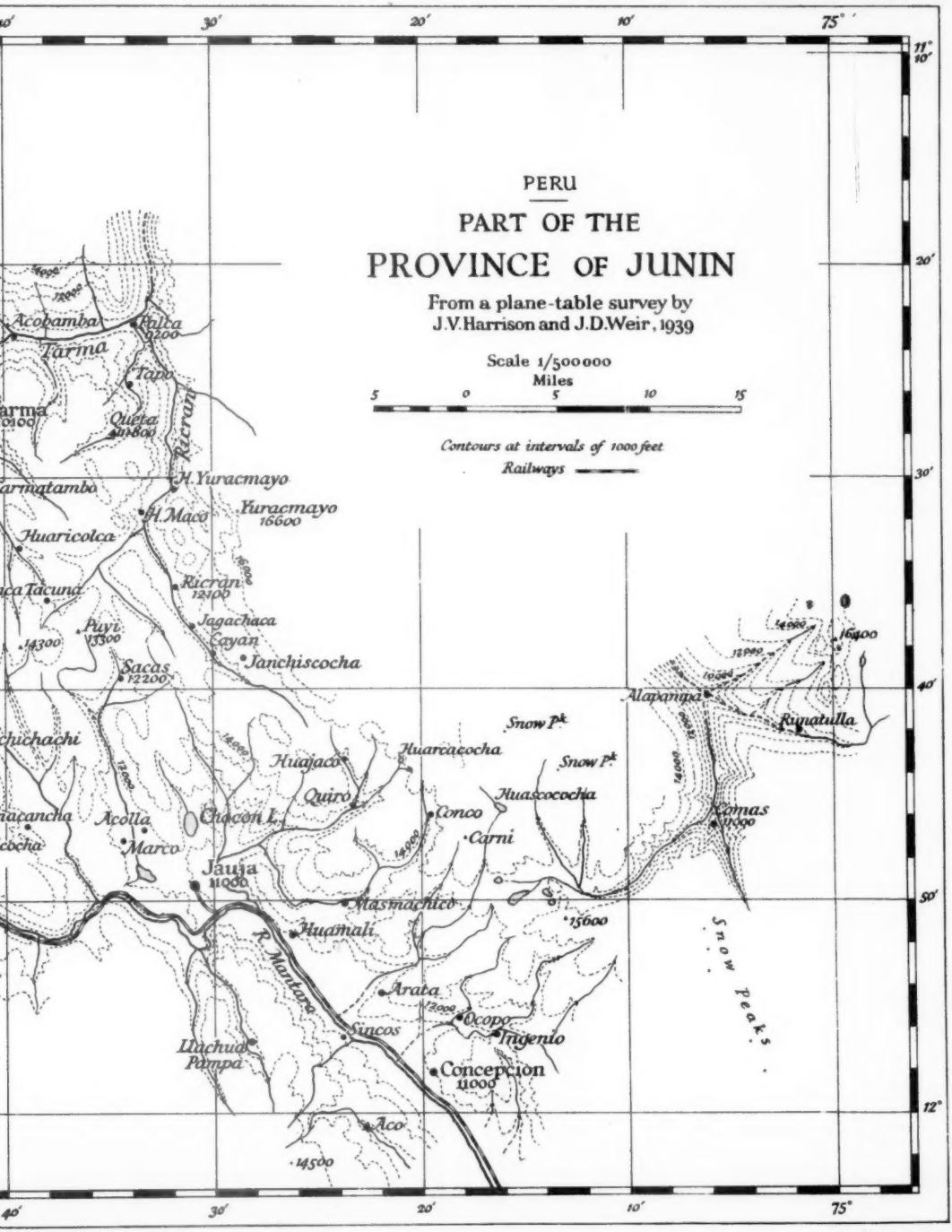
PERU
PART OF THE
PROVINCE OF JUNIN
From a plane-table survey by
J.V. Harrison and J.D. Weir, 1939
Scale 1/500000
Miles
5 0 5 10 15
Contours at intervals of 1000 feet
Railways
Acobamba
Pulca
9200
Tarma
Tapo
Quieta
11800
Ricran
H. Yuracmayo
H. Maco
Yuracmayo
16600
Huaricolca
Ricran
12100
Tacuna
Puyi
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Jagachaca
Cayan
Janchiscocha
Sacas
12200
Alapampa
Runatulla
Snow Pk
Huarcacocha
Snow Pk
Huajaco
Quiro
Huascocohca
Conco
Carni
Chacon L.
Acolla
Marco
Jauja
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Tasmachico
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Huamali
R. Mantaro
Arata
Ocopa
Tingento
Sincos
Huachuc Pampa
Concepcion
11000
Aco
14500
Camas
11000
Snow Peaks
71° 10′
20′
30′
40′
50′
12°
40′
30′
20′
10′
75°

78°

Jokel Fj.

Broken mountainous country

Ice-capped blocks separated by small glaciers

Ekblaw Gl.

Ice-capped blocks separated by small glaciers

Tanquary

Mt. Leeds

Prince of Wales Mountains

Cadogan Gl.

78° 30'

Undulating country mostly ice-covered

Trinity Gl.

178°

Talbot Glacier

Wykeham Gl.

Talbot Inlet

Mt. John Ross

Cape Hurd

Easter I.

Inglefield Mountains

Very broken mountainous country

Cape Mouat

77° 30'

Eskimo Bluff

Boger Bay

Boger Point

Makinson Inlet

Thorndike Peaks

78°

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76°

Alexandra Fj.

Cape Rutherford

Pim I.

C. Sabine

Rice Str.

Johan

Rosse Bay

Peninsula

Cape Herschel

Alfred Newton Glacier

MacMillan Gl.

Wade Point

Baird I.

78° 30'

Baird Inlet

Glacier

Hunt Gl.

Wyville Thompson Glacier

Mt. Leeds

Broken mountainous country

Mt. Bolton

Cape Isabella

Gl.

Cadogan Inlet

Stansfield Pt.

Gale Point

Paget Point

Sparks Gl.

Lyman Glacier

78°

Goding Bay

Paine Bluff

Cape Dunsterville

Orne I.

Cape Faraday

77° 30'

The South East Coast of ELLESMERE ISLAND

from surveys by J.W. Wright and R.A. Hamilton 1938

Scale 1:500 000

5 0 5 10 15 Miles 20

5 0 10 20 Kilometres 30

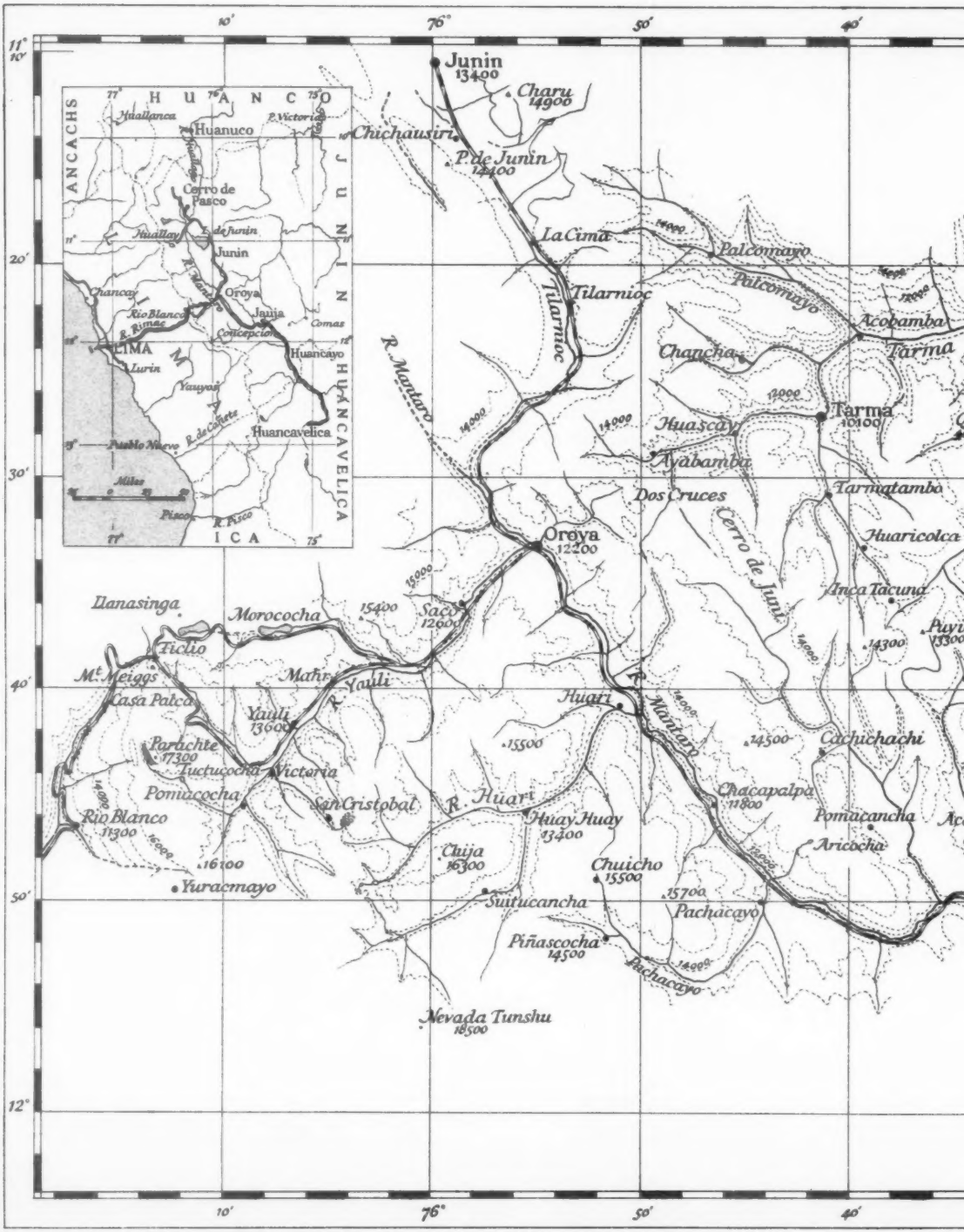
Astronomical station .+ Survey station .○

Astronomical and survey station .✣

Major intersection . Heights in metres

Contours at 100 metre interval

76°



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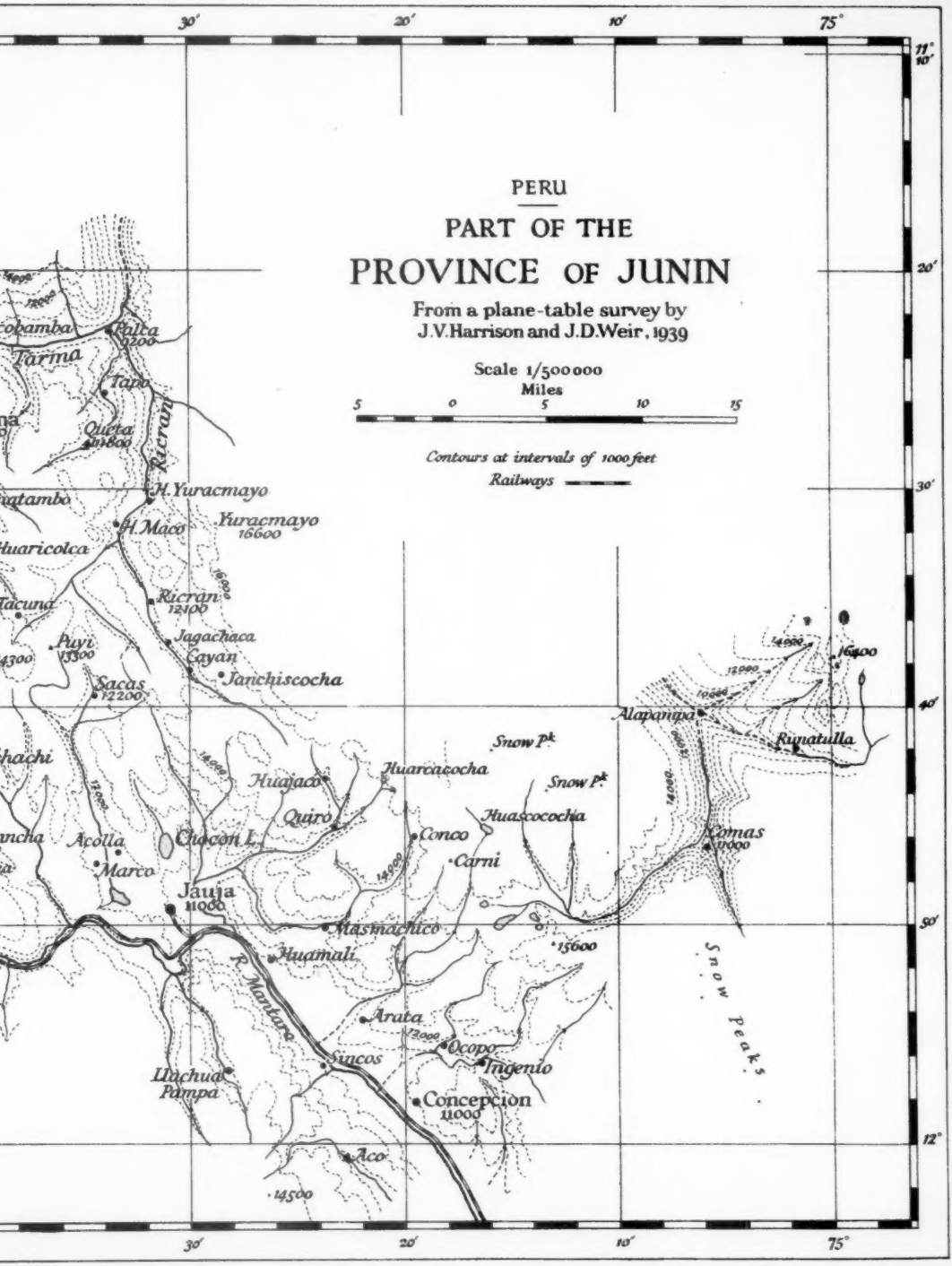
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10′
20′
30′
40′
50′
12°
Tarma
Tapo
Ricran
Quera
H. Yuracmayo
H. Maco
Yuracmayo
16600
Ricran
12100
Jagachaca
Cayan
Janchiscocha
Sacas
12200
Puyi
Huaricolca
Acolla
Marco
Chacon L.
Jauja
11000
Huajaco
Quiro
Huarcacocha
Snow Pk
Huascococha
Conco
Carni
Masmachico
15600
Huamali
R. Mantaro
Arata
12000
Ocopa
Ingenio
Sincos
Concepcion
11000
Llachua
Pampa
Aco
14500
Alapampa
Rinatulla
16400
Comas
11000
Snow Peaks